ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT EIA REPORT

PROPOSED AMAKHALA EMOYENI WIND ENERGY FACILITY

EASTERN CAPE PROVINCE
(DEA Ref No: 12/12/20/1754)

DRAFT EIA REPORT
October 2010

Prepared for:

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PROJECT DETAILS

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PURPOSE OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Windlab Developments South Africa Pty Ltd is proposing to establish a commercial wind energy facility on a site between Cookhouse and Bedford in the Eastern Cape Province. It is proposed for a cluster of up to 350 wind turbines (described as a wind energy facility or a wind farm) to be constructed over an area of approximately 273 km^2 in extent. The site proposed for the Amakhala Emoyeni Wind Energy Facility area falls within the Blue Crane Route Local Municipality.

Windlab Developments South Africa has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Draft Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

» **Chapter 1** provides background to the proposed Amakhala Emoyeni Wind Energy Facility project and the environmental impact assessment
» **Chapter 2** describes the activities associated with the project (project scope).
» **Chapter 3** outlines the regulatory and legal context of the EIA study
» **Chapter 4** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken
» **Chapter 5** describes the existing biophysical and socio-economic environment
» **Chapter 6** describes the assessment of environmental impacts associated with the proposed wind energy facility
» **Chapter 7** presents the conclusions of the impact assessment as well as an impact statement
» **Chapter 8** contains a list references for the EIA report and specialist reports

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and

adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

PUBLIC REVIEW OF THE DRAFT EIA REPORT

The Draft EIA Report is being made available for public review at the following public places in the project area from 18 October 2010 – 16 November 2010:

» Cookhouse Library
» Bedford Library

The report was also made available on:
» www.savannahSA.com

Please submit your comments to
Shawn Johnston of Sustainable Futures ZA PO Box 749, Rondebosch, Cape Town, 7701 Tel: 083 325 9965 Fax: 086 510 2537 E-mail: swjohnston@mweb.co.za

Comments can be made as written submission via fax, post or e-mail.

PUBLIC MEETING

In order to facilitate comments on the findings of the draft EIA report and provide feedback of the findings of the studies undertaken, a public feedback meeting was held. All interested and affected parties were invited to attend a public meeting held on 7 October 2010 at the Bedford Club.

SUMMARY

Background and Project Overview

Windlab Developments South Africa Pty Ltd is proposing to establish a commercial wind energy facility on a site between Cookhouse and Bedford in the Eastern Cape Province. It is proposed for a cluster of up to 350 wind turbines (described as a wind energy facility or a wind farm) to be constructed over an area of approximately 273 km^2 in extent. The site proposed for the Amakhala Emoyeni Wind Energy Facility area falls within the Blue Crane Route Local Municipality.

The generation capacity of the proposed facility is not yet confirmed but the number of turbines in the facility will not exceed 350. It is understood that this facility would be operated as a single facility and would include: wind turbine generators, up to three substations, three power lines linking the facility to the Poseidon Substation, as well as internal access roads.

The site proposed for the Amakhala Emoyeni Wind Energy Facility has been selected at hand of a detailed process of identification and elimination of sites based on a combination of attributes that are required for a suitable wind farm. This is performed by analysing wind energy facility attributes and constraints using computerised Geographical Information System (GIS) overlays including appropriate wind energy, environmental, topographical, infrastructure and residential information in combination with a hand-picking process where the wind engineer applies detailed attention to areas of concern or potential, drawing on their experience of wind turbine siting issues that cannot be purely algorithmically defined.

Site selection draws on macro-level assessment of broad constraints, but also requires that micro-siting issues are considered in order to determine whether the project forms a cohesive unit that as a whole can constitute a potentially viable site. For example, a spread of spots where turbines might be situated which are too far apart may not render a wind energy facility possible.

The study site is situated roughly 15km east-southeast of Cookhouse and approximately 10km south west of Bedford. The wind energy facility is proposed on the following farms:

Portion 1, 2 and remainder of Farm 222; Portion 3 of Farm 203 (Platt House); Remainder of Farm 205 (Kop Leegte); Portion 1 of Farm 206 (Normandale); Remainder of Farm 168 (Stompstaart Fontein); Remainder of Farm 224 (Taai Fontein); Remainder of Farm 221 (Leeuw Fontein); Portion 2 and remainder of Farm 223 (Paarde Kloof); Remainder of Farm 227 (Wilgem Bush); Remainder of Farm

225; Portion1, 2 and remainder of Farm 218 (Brakke Fonteyn); Remainder of Farm 259; Remainder of Farm 260; Portion 5 of Farm 149 (Great Knoffel Fonteyn); Remainder of Farm 242; Portion 1 and remainder of Farm 220 (Brak Fontein); Remainder of Farm 219 (Vogel Fonteyn); Remainder of Farm 169 (Olive Woods Estate); Portion 3 of Farm 141 (Brakfontein); and Portion 1 of Farm 187 (Kleine Knoffel Fonteyn).

The overarching objective for the wind energy facility planning process is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. Local level environmental and planning issues must be considered within site-specific studies and assessments through the EIA process in order to delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

As the performance of the turbines is determined by disturbances to the wind resource, turbines must be appropriately spaced within the facility to minimise the potential for reduced turbine efficiency. A preliminary design for the wind turbines is being considered within this EIA report. The exact positioning or detailed layout of the components of this proposed wind energy facility will be developed by taking cognisance of environmental sensitivities and mitigation measures identified through the EIA process. A final layout of the turbines within the facility would be prepared prior to construction.

The total permanent infrastructure associated with the facility would include:

» Up to **350 wind turbines**.
» **Foundations** (of up to 20 x 20 x 2 m) to support the turbine towers
» **Underground cables** (where practical) between the turbines.
» 3 **substations** to facilitate the connections between the Wind Energy Facility and the existing power lines.
» Internal **access roads** to each turbine.
» Three new sections of overhead **power lines** feeding into the Poseidon substation
» Possible on-site maintenance facility and visitor centre

The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this EIA Report.

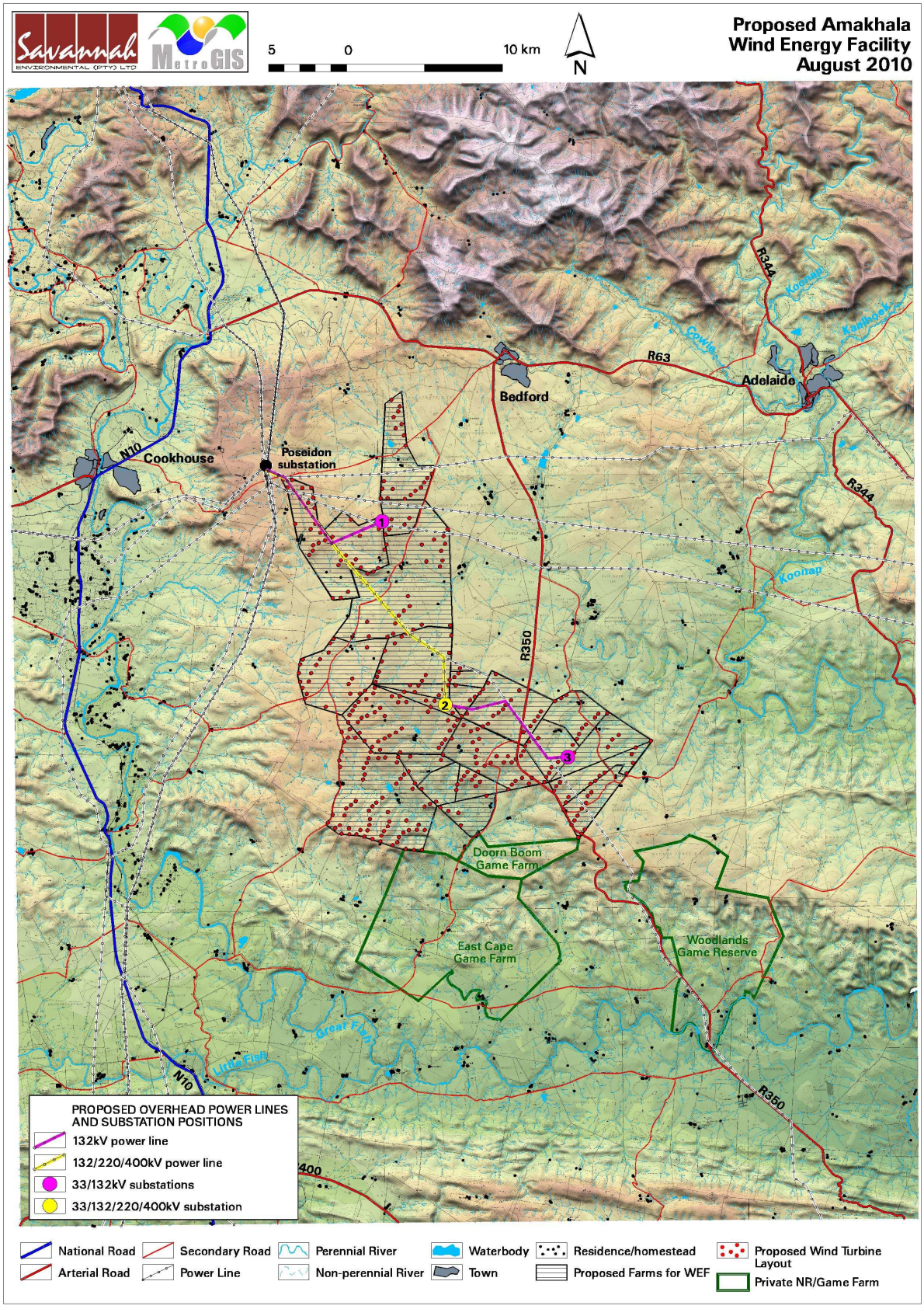

Figure 1: Locality map showing provisional wind turbine layout, proposed substation sites and routes for power line.

Environmental Impact Assessment

The proposed Amakhala Emoyeni Wind Energy Facility project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations and their application to this project. In terms of sections 24 and 24D of NEMA, as read with GNs R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project.

The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by DEA (under Application Reference number 12/12/20/1754). Through the decision-making process, the DEA will be supported by the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA).

The scoping phase for the proposed project forms part of the EIA process and has been undertaken in accordance with the EIA Regulations. The Draft Scoping Report aimed to identify potential issues associated with the proposed project, and define the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project involving specialists with expertise relevant to the nature of the project and the study area, the project proponent, as well as a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

A comprehensive public participation process was undertaken in accordance with Regulation 56 of Government Notice No R385 of 2006 during the Scoping phase of this EIA process. This public participation process comprised the following:

- **Notification of the EIA Process** in local, regional and national newspapers and on site, as well as through written notification to identified stakeholders and affected landowners.
- **Identification and registration** of I&APs and key stakeholders.
- Compilation and distribution of a **Background Information Document** (BID) to all identified I&APs and key stakeholders.
- **On-going consultation** with identified I&APs and stakeholders, including Telephonic communication, Focus Group Meetings and one-one-one meetings.
- Compilation and maintenance of a **database** containing the names and addresses of all identified I&APs and key stakeholders.
- Preparation of a **Comments and Response Report** detailing key

issues raised by I&APs as part of the EIA Process.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.

Issues associated with the Construction, Operation and Decommissioning of Wind Energy Facilities

In summary, the following summarises the potential impact and the assessed significance of these impacts for the wind energy facility and associated infrastructure:

Overall, the proposed wind energy facility is likely to have a **moderate** local and regional negative impact on the **ecology** on site, prior to mitigation. This could be reduced to **moderate – low** negative after mitigation. The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation in development footprints, and long term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. Indirect factors include potential loss of habitat and damage to wetlands.

The primary concern for the proposed facility in terms of **avifauna** will be that of collision of birds with the turbines and earth wires of the power lines. This is a medium-large wind energy project, proposed for a site with few significant conflicting issues in terms of its avifauna. Impacts on avifauna are likely to be of **high** significance prior to mitigation. With the implementation of mitigation measures this can be reduced to a more acceptable **moderate** significance. Although the development area does not impinge significantly on any known major bird fly-ways or unique landscape features, it will potentially affect populations of regionally or nationally threatened (and impact susceptible) bird species likely to occur within or close to the proposed turbine array. The facility may have a detrimental impact on these birds, particularly during its operational phase, unless significant commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to tolerable and sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as

possible about the effects of wind energy developments on South Africa avifauna. The impacts of this development are also required to be viewed in the context of the potential cumulative effects generated by multiple wind energy projects proposed for the immediate vicinity.

The overall impact of all the proposed activity on **geology and soils** is considered **moderate** negative without mitigating measures. With effective implementation of mitigating measures the impacts identified above can be reduced to a **low** level.

The results of the **heritage** survey suggest that the area is of a **moderate** cultural sensitivity, however there are a number of recommendations which must be considered in order to reduce potential impacts on heritage resources from a medium to a more acceptable **moderate-low** significance. There is also the potential for impacts on fossil resources (palaeontology). This impact is potentially of **moderate** significance but can be reduced to **low** significance with the implementation of mitigation and monitoring measures.

The placement of the facility and its associated infrastructure will have a **visual impact** on the natural scenic resources and rural character of this region. The visual impact index map clearly indicates the core area of potentially high visual impact within a 5km radius of the proposed facility. Potential areas of very high visual impact include the R350 arterial road and all the secondary roads. Within a 10km radius, visually exposed homesteads and settlements (sensitive visual receptors) represent sites of potentially very high visual impact. In terms of the protected areas in close proximity to the wind energy facility, the entire Doorn Boom Game Farm will be exposed to high and very high visual impact, as will the northern parts of the Eastern Cape Game Farm and a small section of the Woodlands Game Reserve. The primary visual impact, namely the appearance of the wind energy facility (mainly the wind turbines) is not possible to mitigate. Sections of the R350 arterial road and some secondary roads to the east of the site also have a very high visual impact rating due to the high frequency of observations of the project infrastructure by observers travelling along this road.

The **noise impact** on surrounding areas (outside of the development footprint) are of **low** significance. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of **moderate** significance but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a **low** significance. Care must be taken to ensure that the operations at the wind energy facility do not unduly

cause annoyance or otherwise interfere with the quality of life of the receptors.

Most of the potential **negative impacts on the social environment** as a result of the construction and operation of the wind energy facility are expected to be of **moderate to low** significance, with implementation of the recommended mitigation measures. A number of **positive impacts** have been identified, which could be further enhanced if managed effectively. These benefits relate mostly to a temporary change in the employment and economic profile of the local area by means of employment opportunities, which in turn leads to a positive economic impact on local households, as well as the broader social benefits associated with the development of a clean, renewable energy.

No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However a number of issues requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix O. The most significant environmental impacts associated with the proposed project, as identified through the EIA, include:

» Visual impacts on the natural scenic resources of the region imposed by the components of the facility
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility
» Impacts associated with the access roads, substations and power lines
» Impacts on the social environment

Conclusions

Through pre-feasibility assessments and research, the viability of establishing a 350-turbine wind energy facility on a site between Bedford and Cookhouse has been established by Windlab Developments South Africa. The positive implications of establishing a wind energy facility on the demarcated site within the Eastern Cape include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good wind energy resources at an inland site would be realised.
» The National electricity grid in the Eastern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Positive impacts on the tourism economy of the area.

» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the wind energy facility layout.
» The proposed substation positions and power line corridors are considered to be acceptable from an environmental perspective.
» Based on the findings of the Social Impact Assessment, none of the landowners who stand to be directly affected by the proposed wind energy facility are opposed to the development. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures listed in the report to address the potential negative impacts during the construction phase, specifically the presence of construction workers, should also be implemented.
» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

The impacts associated with the facility as proposed are acceptable from an environmental perspective, subject to the implementation of the recommended mitigation measures and management actions contained in the report. It is recommended that the environmental authorities consider the overall cumulative impact on the proposed facility, as well as the other facilities proposed for the area, in finalising their decision with regard to the potential for cumulative impacts to occur and the optimal number of wind energy facilities in the area.

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APPENDICES

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

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 (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

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.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative 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.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management plan: An operational plan 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.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity.

Indigenous: All biological organisms that occurred naturally within the study area.

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Ramsar Convention on Wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters).

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).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/).

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 80 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 power: A measure of the energy available in the wind.

Wind rose: The term given to 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.

Wind speed: The rate at which air flows past a point above the earth's surface.

Wise Use (*sensu* Convention on Wetlands): Defined in Handbook 1 (citing the third meeting of the Conference of Contracting Parties (Regina, Canada, 27 May to 5 June 1987) as "the wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
DEDEA	Eastern Cape Department of Economic Development and Environmental Affairs
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment
ZVI	Zone of visual influence

INTRODUCTION CHAPTER 1

Windlab Developments South Africa Pty Ltd is proposing to establish a commercial wind energy facility on a site between Cookhouse and Bedford in the Eastern Cape Province. It is proposed for a cluster of up to 350 wind turbines (described as a wind energy facility or a wind farm) to be constructed over an area of approximately 273 km^2 in extent. The site proposed for the Amakhala Emoyeni Wind Energy Facility area falls within the Blue Crane Route Local Municipality.

This facility would be operated as a single facility and would include: up to 350 wind turbine generators, up to three substations, distribution power lines (linking to the Poseidon Substation), as well as internal access roads.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is assessed in more detail in this Draft Environmental Impact Assessment (EIA) Report.

1.1. The Need for the Proposed Project

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and the on-going exploitation of resources. Grid connected renewable energy is currently the fastest growing sector in the global energy market. Installed global wind capacity was in the order of 158GW in 2009, with total world installed capacity having tripled since 2004. Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. The South African Government has recognised the country's high level of renewable energy potential and presently has in place targets of 10 000 GWh of renewable energy by 2013 (to be produced mainly from biomass, wind, solar and small-scale hydro). This is amounts to ~4% (1 667 MW) of the total estimated electricity demand (41 539 MW) by 2013.

To contribute towards this target and towards socio-economic and environmentally sustainable growth, and kick start and stimulate the renewable energy industry in South Africa, the need to establish an appropriate market mechanism was identified, and Feed-in Tariffs (FIT) have been set. FIT are, in essence, guaranteed prices for electricity supply rather than conventional consumer tariffs. The basic economic principle underpinning the FITs is the establishment of a tariff (price) that covers the cost of generation plus a "reasonable profit" to induce developers to invest. This is quite similar to the

concept of cost recovery used in utility rate regulation based on the costs of capital. Feed-in tariffs to promote renewable energy have now been adopted in over 36 countries around the world. The establishment of the Renewable Energy Feed-In Tariff (REFIT) in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector in the country, the region and internationally, and promote competitiveness for renewable energy with conventional energies in the medium- and long-term. Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, the National Energy Regulator of South Africa (NERSA) has the mandate to determine the prices at and conditions under which electricity may be supplied by licence.

Renewable energy is recognised internationally as a major contributor in protecting our climate, nature, and the environment as well as providing a wide range of environmental, economic and social benefits that will contribute towards long-term global sustainability.

It is considered viable that long-term benefits for the community and/or society in general can be realised should this site in the vicinity of Cookhouse and Bedford prove to be acceptable from a technical and environmental perspective for the potential establishment of a wind energy facility. In the event of the wind energy facility being developed, it will contribute to and strengthen the existing electricity grid for the area. In addition, the proposed project will aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs).

At national, regional and local perspectives investment in renewable energy initiatives, such as the proposed wind energy facility, is supported. It is important that at the national level (South Africa being signatories to the Kyoto Protocol) that positive policy is enacted to encourage wind energy (and indeed all renewable) development.

Currently, all power in the Eastern Cape is generated by coal power stations situated in the provinces of Limpopo and Mpumalanga and the Province has limited power generation. A project of this nature will also create needed energy generation capability in the region.

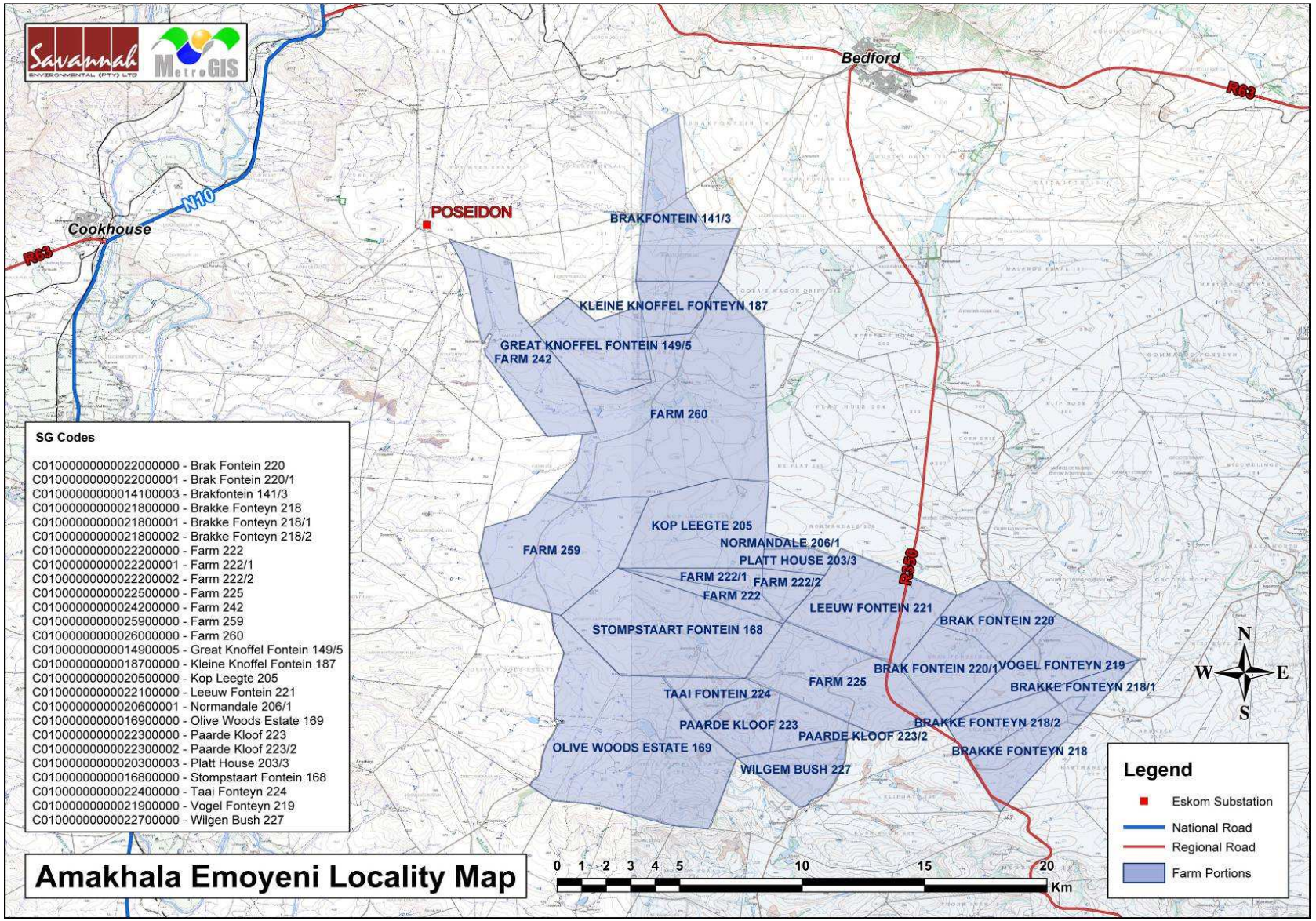


Figure 1.1: Locality map indicating the proposed development site

1.2. Project Overview

The site proposed for the Amakhala Emoyeni Wind Energy Facility area falls within the Blue Crane Route Local Municipality, which falls under the Cacadu District Municipality of the Eastern Cape Province. The wind energy facility is proposed on the following farms (refer to Figure 1.1):

Portion 1, 2 and remainder of Farm 222,
Portion 3 of Farm 203 (Platt House),
Remainder of Farm 205 (Kop Leegte),
Portion 1 of Farm 206 (Normandale),
Remainder of Farm 168 (Stompstaart Fontein),
Remainder of Farm 224 (Taai Fontein),
Remainder of Farm 221 (Leeuw Fontein),
Portion 2 and remainder of Farm 223 (Paarde Kloof),
Remainder of Farm 227 (Wilgem Bush),
Remainder of Farm 225,
Portion 1, 2 and remainder of Farm 218 (Brakke Fonteyn),
Remainder of Farm 259,
Remainder of Farm 260,
Portion 5 of Farm 149 (Great Knoffel Fonteyn),
Remainder of Farm 242,
Portion 1 and remainder of Farm 220 (Brak Fontein),
Remainder of Farm 219 (Vogel Fonteyn),
Remainder of Farm 169 (Olive Woods Estate),
Portion 3 of Farm 141 (Brakfontein), and
Portion 1 of Farm 187 (Kleine Knoffel Fonteyn).

The overarching objective for the wind energy facility planning process is to maximise electricity production through **exposure to the wind resource**, while minimising infrastructure, operational and maintenance costs, as well as **social and environmental impacts**. **Local level environmental and planning issues** must be considered within **site-specific studies** and assessments through the EIA process in order to delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

As the performance of the turbines is determined by disturbances to the wind resource, turbines must be appropriately spaced within the facility to minimise the potential for reduced turbine efficiency. A preliminary design for the wind turbines is being considered within this EIA report. The exact positioning or detailed layout of the components of this proposed wind energy facility will be further developed by taking cognisance of environmental sensitivities and

mitigation measures identified through the EIA process. A final facility layout would be prepared prior to construction.

The total permanent infrastructure associated with the facility (all located with the development footprint) would include:

» Up to **350 wind turbines**.
» **Foundations** (of up to 20 x 20 x 2 m) to support the turbine towers
» **Underground cables** (where practical) between the turbines.
» Up to 3 **substations** (each of up to 250 x 200 m) to facilitate the connections between the wind energy facility and the Poseidon Substation.
» Internal **access roads** to each turbine.
» Overhead **power lines** either feeding into the Poseidon substation.
» Possible on-site maintenance facility and visitor's centre.

The scope of the proposed Amakhala Emoyeni Wind Energy Facility including details of all elements of the project (for the construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.3. Requirement for an Environmental Impact Assessment Process

In order to assess local level environmental and planning issues in sufficient detail, site-specific studies and assessments are required to be undertaken through the EIA process in order to delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

The proposed Amakhala Emoyeni Wind Energy Facility near Bedford is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. As this is a proposed electricity generation project (which is now considered to be of national importance) the National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by DEA (under Application Reference number 12/12/20/1754). Through the decision-making

process, the DEA will be supported by the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA).

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Windlab Developments South Africa (Pty) Ltd appointed Savannah Environmental to conduct the independent Environmental Impact Assessment process for the proposed wind energy facility.

An EIA is also an effective planning and decision-making tool for the project proponent. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issue(s) reported on in the Scoping and EIA reports as well as dialogue with affected parties.

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006):

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Government Notice R387 (21 April 2006)	1(a)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where (i) the electricity output is 20 megawatts or more; or (ii) the elements of the facility cover a combined area in excess of 1 ha
Government Notice R387 (21 April 2006)	1(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kV or more
Government Notice R387 (21 April 2006)	2	Any development, activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be 20 ha or more.

Government Notice R386 (21 April 2006)	1(m)	any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including - (i) canals; (ii) channels; (iii) bridges; (iv) dams; and (v) weirs
Government Notice R386 (21 April 2006)	12	The transformation or removal of indigenous vegetation of 3 ha or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004).
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding (a) masts of 15m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4m or that has a reserve wider than 6m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30m long.
Government Notice R386 (21 April 2006)	16(a)	The transformation of undeveloped, vacant or derelict land to residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 ha.
Government Notice R386 (21 April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30m^3 but less than 1 000m^3 at any one location or site.

1.4. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process refers to the process of identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project in order to identify and describe potential environmental impacts. The Scoping Phase included input from the project proponent, specialists with experience in the study area as well as in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the

project including design, construction, operation and decommissioning, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of the draft EIA Report provides stakeholders with an opportunity to verify the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review of the draft EIA Report prior to submission to DEA.

This EIA Report consists of the following sections:

» **Chapter 1** provides background to the proposed Amakhala Emoyeni Wind Energy Facility project and the environmental impact assessment
» **Chapter 2** describes the activities associated with the project (project scope).
» **Chapter 3** outlines the regulatory and legal context of the EIA study
» **Chapter 4** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken
» **Chapter 5** describes the existing biophysical and socio-economic environment
» **Chapter 6** describes the assessment of environmental impacts associated with the proposed wind energy facility
» **Chapter 7** presents the conclusions of the impact assessment as well as an impact statement
» **Chapter 8** contains a list references for the EIA report and specialist reports

1.5. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA

Savannah Environmental was contracted by Windlab Developments South Africa as an independent consultant to undertake an EIA for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of its specialist sub-consultants on this project are subsidiaries of or affiliated to Windlab Developments South Africa. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental

management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team has considerable experience in environmental assessment and environmental management and have been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa and neighbouring countries. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes. Savannah Environmental has completed the EIA process and reporting for the authorised Eskom Holdings Limited Sere wind energy facility on the West Coast at Skaapvlei, the Umoya Energy (Pty) Ltd Hopefield Wind Energy Facility in the Western Cape, as well as the African Clean Energy Developments Wind Energy Facility near Cookhouse in the Eastern Cape. Savannah Environmental has therefore developed a valuable understanding of impacts associated with such facilities. In addition, Savannah Environmental has successfully managed and undertaken EIA processes for other power generation projects for throughout South Africa. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

OVERVIEW OF THE PROPOSED PROJECT CHAPTER 2

Windlab Developments South Africa (Windlab) is proposing to establish the Amakhala Emoyeni Wind Energy Facility and associated infrastructure in an area between Cookhouse and Bedford in the Eastern Cape Province. A study area of approximately 273 km^2 is being considered as a larger study area for the construction of the proposed wind energy facility, and would include:

» Up to **350 wind turbines**.
» **Foundations** (of up to 20 x 20 x 2 m) to support the turbine towers
» **Underground cables** (where practical) between the turbines.
» Up to 3 **substations** (each of up to 250 x 200 m, two 33/132kV substations and one 33/132/220/400 kV substation) to facilitate the connections between the wind energy facility and the Poseidon substation.
» Internal **access roads** to each turbine (4 - 6 m wide during construction, reduced to 3 – 4 m wide during operation).
» Two new sections of 132kV overhead **powerlines** and one new section of 33/132/220/400kV power line feeding into the Poseidon substation.
» Possible on-site maintenance facility and visitor centre

This chapter provides details regarding the scope of the proposed Amakhala Emoyeni Wind Energy Facility. The scope of project includes construction, operation and decommissioning activities. This chapter also explores wind energy as a power generation technology, as well as the alternative options with regards to the proposed wind energy facility development, including the "do nothing" option.

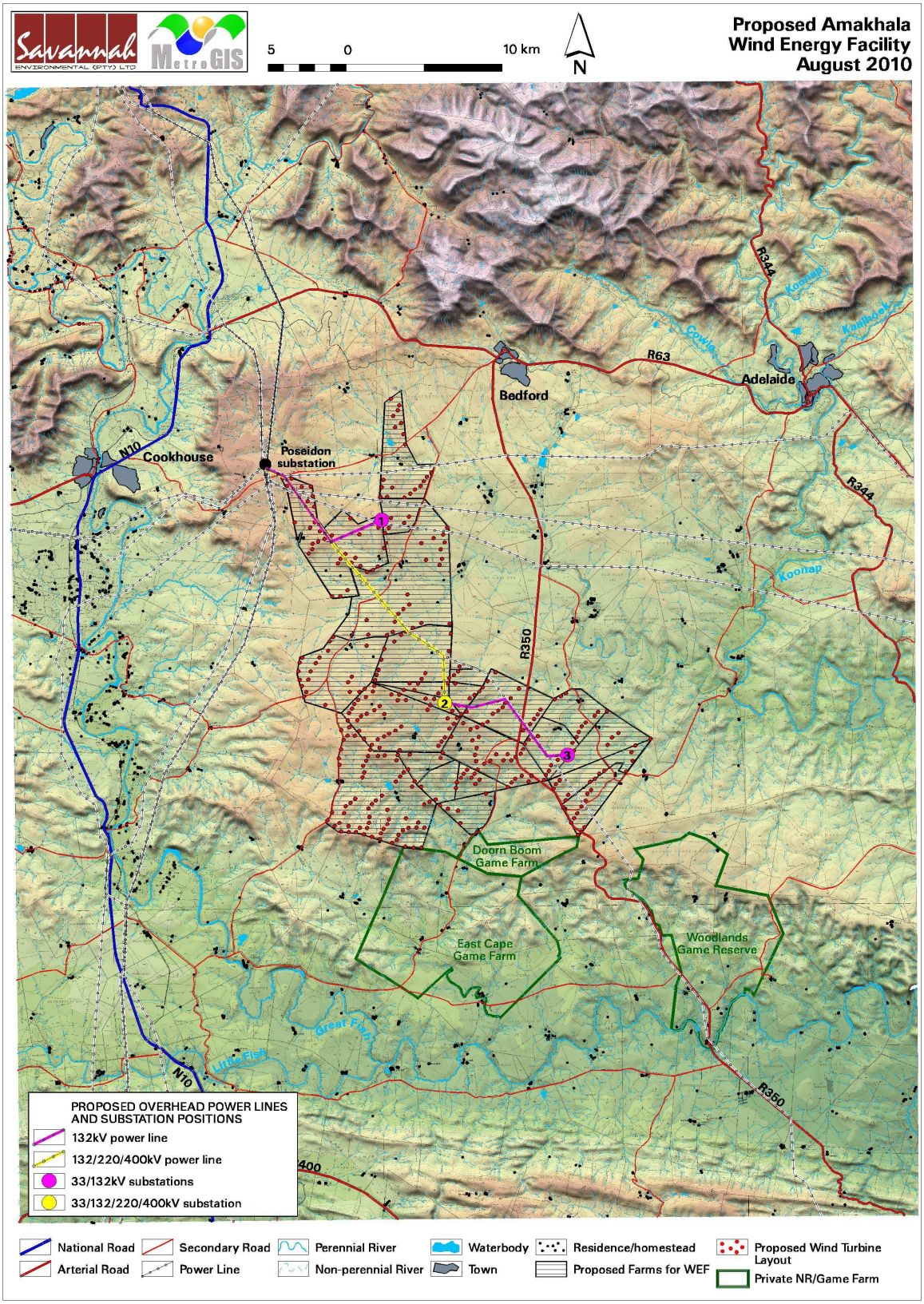


Figure 2.1: Locality map showing provisional wind turbine layout, proposed substation sites and power line corridors.

2.1. Site Selection

The site for the proposed for the Amakhala Emoyeni Wind Energy Facility has been identified by Windlab Developments South Africa as a highly desirable site based on extensive pre-feasibility analysis. The site was selected through a detailed process of identification and elimination of sites based on a combination of attributes that are required for a suitable, viable and sustainable wind energy facility. This is performed by analysing wind energy facility attributes and constraints using computerised Geographical Information System (GIS) overlays including appropriate wind energy, environmental, topographical, infrastructure and residential information in combination, with a hand-picking process where the wind engineer applies detailed attention to areas of concern or potential, drawing on their experience of wind turbine siting issues that cannot be purely algorithmically defined.

Site selection draws on macro-level assessment of broad constraints, but also requires that micro-siting issues are considered in order to determine whether the project forms a cohesive unit that, as a whole, can constitute a potentially viable site. For example, a spread of positions where turbines might be situated which are too far apart may not render a wind energy facility possible.

The site selection process that resulted in choosing this location near Bedford involved a narrowing focus from a regional level through to a local level, as follows:

1. Regional areas of wind resource potential were identified after applying constraints at a macro level such as: topographical, grid infrastructure, land tenure, flora and fauna and housing.
2. Local constraints within each region were identified and mapped.
3. Individual wind energy facility locations were provisionally identified.
4. These were ranked according to high level criteria and the short-list passed to the next phase.
5. A "virtual wind farm" was developed for each shortlisted site. The provisional energy generation potential was determined using Windlab's proprietary wind analysis techniques, micro-siting constraints and key risks for the project concept identified.
6. The "virtual wind farms" were ranked and the list pared down to the selected site: Amakhala Emoyeni.

Constraints considered in the site selection process included, but were not limited to the following:

1. Engineering and economic constraints
    * These constraints are driven by the wind developer's understanding of the factors that make a wind energy facility feasible from an engineering perspective, as well as the impact of variables on the financial model.
2. Social and environmental constraints
    * Preliminary assessment of constraints is conducted using the project sponsor's experience and understanding of interaction of wind energy facilities with the social and ecological setting. Key experts and stakeholders were consulted at an early stage to inform this process.
    * At a more detailed level, this is the domain where the relevant government departments, social organisations and consultants are best equipped to evaluate concerns during the consultative phases of the project.

2.1.1. Engineering and economic constraints

» ***Wind resource***

Without the wind resource there is no wind energy facility. Hence, this is selection gate number one. Other constraints need not be considered if the region does not have the appropriate resource. Windlab was launched out of the CSIRO in Australia in 2003 on the basis of the development of a high-resolution wind mapping software, *WindScape*. This in-house capability enables Windlab to identify regions with promising wind resource at a very early stage of the project with significantly higher certainty than would be possible otherwise, thereby improving the ability to identify economically viable sites.

On-site measurement to provide bankable data to verify the resource is still required. However, with this upfront increased confidence in the first site selection gate, wastage of time and resources into assessment of other concerns at poor wind resource sites can be minimised.

The wind resource is defined in terms beyond average wind speed and includes Weibull distribution, turbulence and wind rose (pattern of wind direction) – these all being key items that determine whether micro-siting constraints will render the project suitable as a whole.

Windlab's preliminary assessment of the wind resource from measurement at the Amakhala Emoyeni site indicates that the proposed project would generate sufficient energy to support an economically viable wind energy facility within bounds of uncertainty considered acceptable at this stage of development.

» ***Terrain and access***

Complex terrain introduces wind flow effects such as turbulence that may not be acceptable for turbine siting. Terrain alignment with respect to the wind rose also needs to be assessed in order to ensure that workable turbine spacing can be effected. Access roads to the region must be assessed and complex terrain may typically bring with it access constraints due to limited road infrastructure and constricted turning circles.

The terrain at Amakhala Emoyeni is considered by Windlab to be highly suitable for a wind energy facility installation, with a low level of terrain complexity and good access infrastructure into the area.

» ***Existing grid infrastructure***

The electricity grid infrastructure in the region needs to be of sufficient strength and configured in such a way as to be able to accept the incoming power produced by the facility. Upgrades and the length of additional lines required to reach the infrastructure will add to the cost and viability of the project. The exact length and extent of these requirements (and what a project can support) differs from project to project.

With the presence of the Poseidon Substation on the border of the Amakhala Emoyeni development, as well as a strong network of transmission lines in the area, Windlab consider the site to have a high capacity to accept the available power.

» ***Land tenure***

The wind energy facility will form a complementary use of the involved land, where it will need to exist alongside other land uses such as agriculture. It is therefore essential that the land involved is available in terms of the land use being compatible and the landowners being amenable to the development of the potential facility.

Windlab have reached agreement with the owners of the land included within the proposed development footprint to enable the development of the project and the current land uses (which are predominantly grazing) are highly compatible with a wind energy facility.

2.1.2. Social and environmental constraints

The detailed assessment of potential socio-environmental opportunities and/or constraints is performed in the EIA process undertaken for the proposed development. However, preliminary assessments of the environmental issues are conducted by the developer on a macro-scale during the process of site selection.

Key concerns are primarily proximity-based and include taking cognisance of warning signs from the following:

» Nature reserves
» Avian breeding grounds
» Residential areas
    * Proximity to clustered residential areas will raise the setbacks required for background noise concerns and increases the risk of visual impact.
    * Scattered residences, including those of landowners involved in the project are addressed as a micro-siting constraint
» Scenic landmarks
» Aviation zones – airports and immediate aircraft flight paths

Where proximity-based constraints can be applied, a GIS layer has been applied to the prospecting/site selection process. It is acknowledged that other concerns need to be addressed on an individual basis by consultation with stakeholders.

Windlab's preliminary assessment in this regard rendered the view that the social and environmental issues investigated are compatible with the installation of a wind energy project at the Amakhala Emoyeni site. A full environmental impact assessment was then commissioned to evaluate key concerns through a more in-depth assessment.

From the pre-feasibility analysis and site identification process undertaken by Windlab, Windlab consider the site a highly preferred site for wind energy facility development. No further siting alternatives have been considered in this EIA process.

Monitored data is also being recorded from wind monitoring masts erected on the site (DEA reference number 12/12/20/1727).

2.1.3. Site-specific or Layout Design Alternatives

Local level issues are now being considered within the site-specific studies and assessments through the EIA in order to delineate areas of sensitivity within the broader area identified for the establishment of the wind energy facility. Through the process of determining constraining factors, the layout of the wind turbines and infrastructure was planned. The overall aim is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. Specialist software is available to assist developers in selecting the

optimum position for each turbine. This micro-siting information was provided to inform the specialist impact assessments.

There are two 33/132kV substations and one 33/132/220/400 kV substation to be constructed within the site footprint. The turbines will be connected to the substations via underground 33 kV cabling where practical (for instance where a geological feature or a stream may require the cable to go above ground for a short distance). Power lines are proposed to connect the substations at the wind energy facility to the electricity distribution network/grid at Poseidon Substation located adjacent to the proposed site. Two new sections of 132kV overhead power lines and one new section of 33/132/220/400kV power line will connect the substations to the electricity distribution network/grid, linking to the Poseidon Substation located adjacent to the site. These will be between 132 kV and 400 kV lattice overhead lines. They are proposed to follow existing power line corridors as far as possible (Figure 2.1).

These new power lines are all restricted to the site development footprint itself, without traversing any adjacent land. The substations and associated power lines are not expected to create a major negative visual disturbance, as this smaller scale infrastructure will be dominated by the much taller wind turbines and thus blend in with the facility (Visual Impact Assessment, Appendix I). Therefore, **no alternative power line routes/corridors or substation sites** are being considered through the EIA. The sensitivity of the proposed routes for the power lines and proposed substation positions are assessed through this EIA report.

2.1.4. The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Amakhala Emoyeni Wind Energy Facility on the identified site near Bedford.

Through research, the viability of a wind energy facility has been established from a technical perspective, and Windlab propose that up to 350 turbines can be established on the identified site as part of the Amakhala Emoyeni Wind Energy Facility.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal based power generation, with the country's significant renewable energy potential largely untapped to date. The 'do nothing' alternative will not assist the South African government in reaching their set targets for renewable energy. In addition, the Eastern Cape power supply will not benefit

from the additional generated power being evacuated directly into the Province's grid.

The growing electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. There is therefore a need for additional electricity generation options to be developed throughout the country. 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 - and more so when social and environmental costs are taken into account.

Wind energy is one of the fastest growing electricity generating technologies and features in energy plans worldwide. Use of wind for electricity generation is essentially a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its life cycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production. Operation does not produce carbon dioxide, sulfur dioxide, mercury, particulates, or any other type of air pollution, as do fossil fuel power sources. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard.

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The climate change challenge needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. However, it is important to acknowledge that the more cost effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future. The challenge is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

The generation of electricity from renewable energy in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in further detail in the South Africa Renewable Energy Feed-in Tariff (REFIT) Regulatory Guideline published by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are a major consumer of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, where compared with wet cooled conventional power stations. This translates into a revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.
» **Exploitation of our significant renewable energy resource:** At present, valuable national resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The release of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.
» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.
» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» **Support to a new industry sector:** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contribution to final energy consumption by 2013. The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. The Department of Energy's macroeconomic study of renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. In addition, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh (South Africa Renewable Energy Feed-in Tariff (REFIT) Regulatory Guideline published by NERSA (March 2009)). The establishment of the wind energy facility would also lead to the increased use of clean energy.

As the "do-nothing" alternative will not provide assist in meeting South Africa's renewable energy targets, this option is not a preferred alternative and will not be assessed in further detail.

2.2. Technology Alternatives

Windlab Developments South Africa will be considering various wind turbine designs and layouts in order to maximise the capacity of the site. The turbines being considered for use at this wind energy facility will be between 1.5 MW and 3 MW in capacity. The turbines will have a hub height of up to 100 m and a rotor diameter of up to 120m (i.e. each blade up to 60m in length). The technology provider has not yet been confirmed and will be selected after further wind analysis and a detailed tender process.

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. The use of wind for electricity generation is a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its lifecycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production.

Wind energy has the attractive attribute that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the site. Detailed and reliable information about the speed, strength, direction, and frequency of the wind resource is vital when considering the installation of a wind energy facility, as the wind resource is a critical factor to the success of the installation.

South Africa can be considered as having a moderate wind resource as compared to Northern Europe, Great Britain and Ireland and New Zealand. Typical annual wind speeds range from 15 km/hr to 25 km/hr (4 m/s to 7 m/s) around South Africa's southern, eastern and western coastlines (with more wind typically along the coastline). This relates to an expected annual energy utilisation factor of between 15% and 30% (the site proposed for the Amakhala Emoyeni Wind Energy Facility is expected to have a higher capacity factor than 30%), the value depending on the specific site selected. It is commonly accepted that wind speeds of 25 km/hr to 30 km/hr (7 m/s to 8 m/s) or greater are required for a wind energy facility to be economically viable in Europe.

A wind resource measurement and analysis programme is being conducted by Windlab Developments South Africa for the site proposed for development, as only measured data will provide a robust prediction of the facility's expected energy production over its lifetime. The wind speed measurements taken at a particular site are affected by the local topography (extending to a few tens of kilometres from the mast) and surface roughness. This is why local on-site monitored wind speed data is so important for detailed wind energy facility design. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography exerts a profound influence on the flow of air, and results in turbulence within the air stream, and this also has to be taken into account in the placement of turbines.

Wind monitoring masts are currently installed to monitor wind at the proposed site. The design (and micro-siting) of a wind energy facility is sensitive to the predominant wind directions and wind speeds for the site. Although modern wind turbines are able to yaw to the direction of the wind, the micro-siting must consider the wind direction and strength of the wind in the optimal positioning of the turbines.

The placement of a wind energy facility and the actual individual turbines must, therefore, consider the following technical factors:

» Predominant wind direction and frequency
» Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)

» Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately greater than 2 to 3xD apart, and greater than 5 to 7xD where a turbine is behind another relative to the prevailing wind direction (D = the diameter of the rotor blades). This is required to minimise the induced wake effect the turbines might have on each other. Considering a typical 2 MW capacity turbine whose rotor is approximately 90 m in diameter, each turbine would be separated by at least approximately 180 m to 300 m. The erection of turbines in parallel rows one behind another would require a distance between rows of at least 500 m to 700 m to avoid wake effects from one turbine onto another. The provisional micro-siting of the turbines on the site has been determined using industry standard software systems, which automatically consider the spacing requirements.

2.3. How wind turbines function

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. The use of wind for electricity generation is a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its lifecycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production.

Wind energy is one of the fastest growing electricity generating technologies and features in energy plans worldwide. Use of wind for electricity generation is essentially a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its life cycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production. Operation does not produce carbon dioxide, sulfur dioxide, mercury, particulates, or any other type of air pollution, as do fossil fuel power sources. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard.

Wind turbines, like windmills, are mounted on a tower to capture the most energy possible. The kinetic energy of wind is used to turn a wind turbine to generate electricity. At 30 m or more aboveground, they can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Usually, two or three blades are mounted on a shaft to form a **rotor**. Generally a wind turbine consists of **three rotor blades** and a **nacelle** mounted at the tip of a tapered **steel tower**. The mechanical power generated by the rotation of the

blades is transmitted to the generator within the nacelle via a gearbox and drive train.

The proposed wind energy facility would accommodate up to 350 wind turbines. As the performance of the turbines is determined by disturbances to the wind resource, they must be appropriately spaced within the facility. Turbines would, therefore, be positioned within an area of approximately 273 km^2. The overall aim of the design and layout of the facility is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, as well as social and environmental impacts. Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed wind energy facility will have a hub height up to 100 m, and a rotor diameter of up to 120 m (i.e. each blade ~60 m in length). Note that these are the maximum turbine dimensions being considered by the developer and it is possible that the proposed facility may make use of smaller turbines, or fewer numbers of turbines.

Other infrastructure associated with the facility includes internal service roads, an access road and substations (placed within the facility). The construction phase of the wind energy facility is dependent on the number of turbines erected and is estimated at one week per turbine. However there may be construction activities occurring simultaneously (e.g. excavation of foundations and turbines being lifted in other parts of site). The lifespan of the facility is approximated at 20 to 30 years.

2.3.1. Main Components of a Wind Turbine

A wind turbine consists of the following major components:
» The rotor
» The nacelle
» The tower
» The foundation unit

The 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). The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

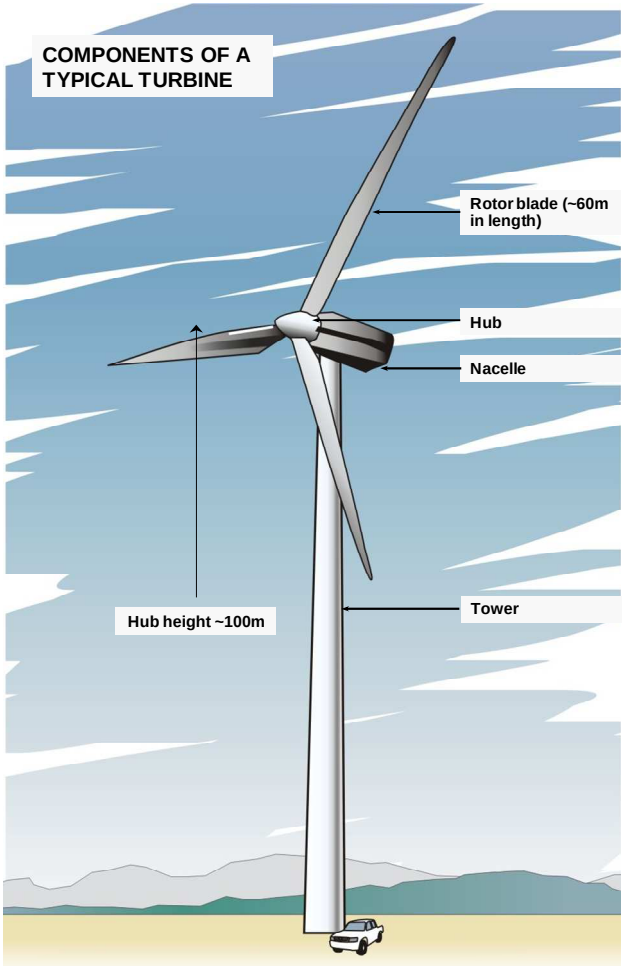


Figure 2.2: Illustration of the main components of a wind turbine.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of lift. When air flows past the blade, a wind speed and pressure differential is created between the upper and lower blade surfaces. The pressure at the lower surface is greater and thus acts to "lift" the blade. When blades are attached to a central axis, like a wind turbine rotor, the lift is translated into rotational motion. Lift-powered wind turbines are well suited for electricity generation.

The rotation of the rotor blades produces a characteristic 'swishing' sound as the blades pass in front of the tower roughly once a second. The other moving parts, the gearbox and generator, cannot be heard unless the observer is physically inside the turbine tower.

The tip-speed is the ratio of the rotational speed of the blade to the wind speed. The larger this ratio, the faster the rotation of the wind turbine rotor at a given

wind speed. Electricity generation requires high rotational speeds. Lift-type wind turbines have optimum tip-speed ratios of around 4 to 5.

The nacelle

The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction. The generator converts the turning motion of a wind turbine's blades into electricity. Inside this component, coils of wire are rotated in a magnetic field to produce electricity. The generator's rating, or size, is dependent on the length of the wind turbine's blades because more energy is captured by longer blades (the ratio of blade length to generator rating varies for different conditions).

The tower

The tower, which supports the rotor, is constructed from tubular steel. The tower will be up to 100 m tall, depending on the turbine type chosen for the wind energy facility. The nacelle and the rotor are attached to the top of the tower.

The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. 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.

2.3.2. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a wind energy facility can be monitored and controlled remotely, with a mobile team for maintenance, when required.

Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (12.5 m/s and 17 m/s).

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 10 and 15 km/hr (~3 m/s and 4 m/s).

At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is 59.3%. This value is known as the Betz Limit. If the blades were 100% efficient, a wind turbine would not work because the air, having given up all its energy, would entirely stop. In practice, the collection efficiency of a rotor is not as high as 59%. A more typical efficiency is 35% to 45%. A wind energy system (including rotor, generator etc) does not exhibit perfect efficiencies, and will therefore deliver between 10% and 30% of the original energy available in the wind (between 20% to 25% being typical for modern systems).

Wind turbines can be used as stand-alone applications, or they can be connected to a utility power grid. For utility-scale sources of wind energy, a large number of wind turbines are usually built close together to form a **wind energy facility.**

2.4. Project Construction and Operation

The construction phase of the wind energy facility is dependent on the number of turbines to be erected, but can be estimated at one week per turbine. The lifespan of the facility is approximated at 20 to 30 years. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The following construction activities have been considered to form part of the project scope:

» Conduct Surveys
» Establishment of Access Roads to the Site
» Undertake Site Preparation
» Transport of Components and Equipment to Site
» Establishment of Laydown Areas on Site
» Construct Foundation
» Construct Turbines
» Construct Substations
» Establishment of Ancillary Infrastructure
» Connection of Wind Turbines to the Substations
» Connect Substations to Power Grid
» Undertake Site Remediation

These are discussed in further detail below.

Table 2.1: Activities associated with construction, operation and decommissioning of a Wind Energy Facility

Activity	Description
Construction Phase	
Conduct Surveys	Prior to initiating construction, a number of surveys will be required including, but not limited to: » geotechnical survey » site survey » confirmation of the turbine micro-siting footprint » survey of substation site/s » survey of power line servitudes to determine tower locations.
Establishment of Access Roads to the Site	The site is located approximately 10 km east of the N10 national road (at its closest border). Access/haul roads to the site as well as internal access roads within the site are required to be established. Access to the site is likely to be from the R350 Bedford – Grahamstown road which runs through the eastern portion of the proposed site (refer to Figure 2.1). As far as possible, existing access roads to the site would be utilised, and upgraded where required. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines. These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. The width of the internal access roads will be 4 - 6 m wide. These will be rehabilitated and reduced to 3 – 4 m during operation of the facility.
Undertake Site Preparation	Site preparation activities will include: » clearance of vegetation at the footprint of each turbine » the establishment of internal access roads » excavations for foundations These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.
Construct Foundation	Concrete foundations will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 2 m to 3 m. Concrete is proposed to be brought to site as ready-mix. The reinforced concrete foundation of approximately 20 m x 20 m x 2 m will be poured and support a mounting ring. The foundation will then be left up to a week to cure.
Transport of	The wind turbine, including the tower, will be brought on site by the

Activity	Description
Components and Equipment to Site	turbine supplier in sections on flatbed trucks. Turbine units which must be transported to site consist of: the tower (in segments), nacelle, and three rotor blades. The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). In addition, components of various specialised construction and lifting equipment/cranes are required on site to erect the wind turbines and need to be transported to site. In addition, the normal civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.). The components required for the establishment of the substation/s (including transformers) as well as the power lines (including towers and cabling) will also be transported to site as required. The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (e.g. widening on corners), accommodation of street furniture (e.g. street lighting, traffic signals, telephone lines etc) and protection of road-related structures (i.e. bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. Before permits are granted for abnormal transport, a route survey/clearance needs to be submitted to the authorities. In addition accurate drawings of the load and the vehicle/trailer combination also need to be submitted. The equipment will be transported to the site using appropriate National and Provincial roads, and the dedicated access/haul road to the site itself. Two possible transport routes from the Port of Coega to the Amakhala Emoyeni Wind Energy Facility site were assessed in a desktop route survey (refer to Appendix N): (1) via Cookhouse and (2) via Grahamstown. Of the two routes investigated, the route via Cookhouse was identified as a more preferable option from the desktop survey.
Establishment of Laydown Areas on Site	Laydown areas will need to be established at each turbine position for the storage of wind turbine components. The laydown area will need to accommodate the cranes required in tower/turbine assembly. A large laydown area of approximately 60 m x 60 m will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. Laydown and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.
Construct Turbine	A large lifting crane will be brought on site. It will lift the tower sections

Activity	Description
	into place. The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. It will then be lifted to the nacelle and bolted in place. A small crane will likely be needed for the assembly of the rotor while a large crane will be needed to put it in place. It will take approximately 2 days to erect a single turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.
Construct Substations	Up to three substations will be constructed within the site footprint. The turbines will be connected to the substations via 33 kV cabling. The positions of the substations are informed by the final micro-siting/positioning of the wind turbines. Each substation will be constructed within a secured high-voltage (HV) yard. The construction of the substations would require a survey of the site; site clearing and levelling and construction of access road/s to substation site (where required); construction of substation terrace and foundations; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Establishment of Ancillary Infrastructure	A laydown area for building materials will be required. A maintenance area with workshop will be required on site.
Connection of Wind Turbines to the Substation	Each wind turbine will be connected to an optimally positioned substation via underground 33 kV cabling where practical (for instance, a geological feature or a stream may require the cable to go above ground for a short distance). The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables will be planned to follow the internal access roads, where possible.
Connect Substation/s to Power Grid	Two new sections of 132kV overhead power lines and one new section of 33/132/220/400kV power line will connect the substations to the electricity distribution network/grid, linking to the Poseidon Substation located adjacent to the site. Routes for the power lines will be assessed, surveyed and pegged prior to construction.
Undertake Site Remediation	As construction is completed in an area, and as all construction equipment is removed from the site, the site rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

Activity	Description
Operation Phase	
Monitoring and maintenance	Based on information from similar studies, the proposed wind energy facility will employ approximately 90 full time employees over 25-year period. It is likely that no permanent staff will be required on site for any extended period of time. Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. The wind turbine will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.
Decommissioning Phase	
Turbine infrastructure utilised for wind energy facilities is typically expected to have a lifespan of approximately 20 - 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.	
Site Preparation	Site preparation activities will include confirming the integrity of the access to the site to accommodate required equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.
Disassemble and Replace Existing Turbines	A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable except for the blades.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1 Policy and Planning Context for Wind Energy Facility Development in South Africa

The need to expand electricity generation capacity in South Africa is based on **national policy** and informed by on-going strategic planning undertaken by the Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in Figure 3.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the proposed wind energy facility's development.

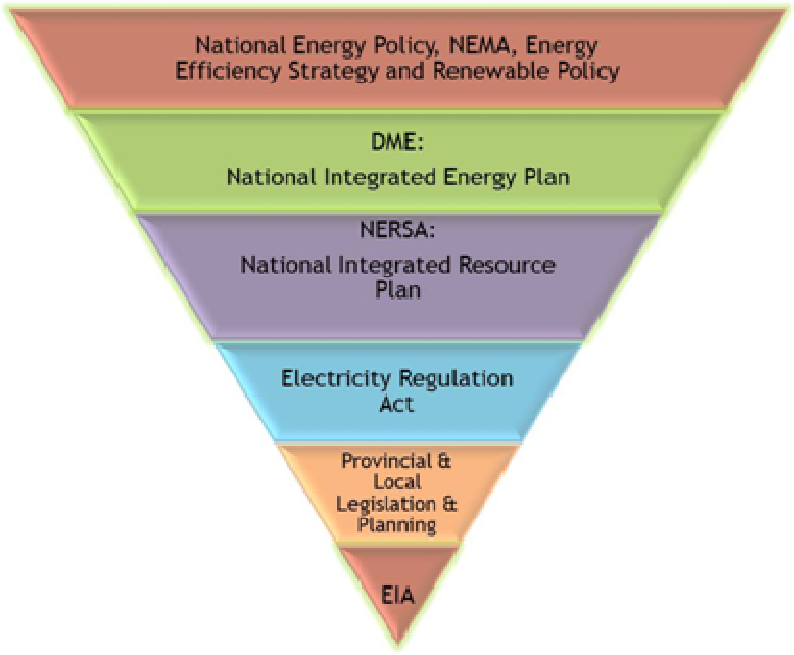


Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1 White Paper on the Energy Policy of the Republic of South Africa, 1998

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by the Department of Minerals and Energy (DME) in 1998. This White Paper identifies key objectives for energy supply within South Africa, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes that government policy is based on an understanding that renewable energy sources have significant medium- and long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. 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.

3.1.2 Renewable Energy Policy in South Africa, 1998

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. The support for the 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 from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. Government policy on renewable energy is therefore concerned with meeting economic, technical and other constraints on the development of the renewable industry.

In order to meet the long-term goal of a sustainable renewable energy industry, the South African Government has set the following 10-year target for renewable energy: "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013"* (DME, 2003).

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet. Wind energy is a clean, renewable resource and should be developed in South Africa on the basis of national policy as well as provincial and regional guidelines*."

3.1.3 Integrated Energy Plan (IEP), 2003

In response to the requirements of the National Energy Policy, the DME commissioned the Integrated Energy Plan (IEP) to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

The current IEP recognises that South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy. However, there is potential and a need to diversify energy supply through increased use of natural gas and new and renewable energies.

3.1.4 National Integrated Resource Plan (NIRP), 2003/2004

In response to the National Energy Policy's objective relating to affordable energy services, NERSA commissioned a National Integrated Resource Plan (NIRP) in order to provide a long-term (from 2003 to 2022), cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies. The planning horizon for the study was from 2003 to 2022. The objective of the NIRP is to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power generating projects, and evaluate the security of supply. The Long-term Electricity Planning goal is to ensure sustainable development considering technical constraints, economic constraints, social constraints and externalities.

Various demand side management and supply-side options are considered in the NIRP process, prior to identifying the least cost supply options for South Africa. The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010.

The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, updated on 29 January 2010. The Department of Energy is currently revisiting and revising the IRP, with the IRP2010 expected to be published by the end of 2010.

3.1.5 Electricity Regulation Act, 2006

To contribute towards the renewable energy target set by the Government, socio-economic and environmentally sustainable growth, and kick start and stimulate the renewable energy industry in South Africa, Renewable Energy Feed-in Tariffs (REFIT) have been set by the National Energy Regulator of South Africa (NERSA). REFITs are, in essence, guaranteed prices for electricity supply rather than conventional consumer tariffs. The basic economic principle underpinning the REFITs is the establishment of a tariff (price) that covers the cost of generation plus a "reasonable profit" to induce developers to invest. This is quite similar to the concept of cost recovery used in utility rate regulation based on the costs of capital. Feed-in tariffs to promote renewable energy have now been adopted in over 36 countries around the world. The establishment of the Renewable Energy Feed-In Tariff (REFIT) in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector in the country, the region and internationally, and promote competitiveness for renewable energy with conventional energies in the medium- and long-term. Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers (IPPs).

3.2. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

At National Level, the main regulatory agencies are:

Department of Energy (formerly DME)	This department is responsible for policy relating to all energy forms, including renewable energy. Wind energy is considered under the White Paper for Renewable Energy and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Act (Act No 41 of 1987).
National Energy Regulator of South Africa (NERSA)	This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
Department of Environmental Affairs (DEA)	This Department is responsible for environmental policy and is the controlling authority in terms of NEMA

	and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
The South African Heritage Resources Agency (SAHRA)	The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.
Department of Transport - Civil Aviation Authority (CAA)	This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
South African National Roads Agency (SANRAL)	This department is responsible for all National road routes.

At Provincial Level, the main regulatory agencies are:

Provincial Government of the Eastern Cape – Department of Economic Development and Environmental Affairs (DEDEA)	This Department is responsible for environmental policy and is the Provincial authority in terms of NEMA and the EIA Regulations. The DEDEA is the commenting authority for this project.
Department of Transport and Public Works	This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
CapeNature	This Department's involvement relates specifically to the biodiversity and ecological aspects of the proposed development activities on the receiving environment to ensure that developments do not compromise the biodiversity value of an area. The Department considers the significance of impacts specifically in threatened ecosystems as identified by the National Spatial Biodiversity Assessment or systematic biodiversity plans.

At Local Level the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Eastern Cape, both Municipalities and District Municipalities play a role. The local municipality is the *Blue Crane route Local Municipality*, which forms part of the greater *Cacadu District Municipality*.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic

resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.

» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.

There are also numerous non-statutory bodies such as Wind Energy Associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence wind energy development.

3.3 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Draft EIA Report:

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  * Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006)
  * Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)

Acts, standards or guidelines which have informed the project process and the scope of issues assessed within this EIA are summarised in Table 3.1.

Table 3.1: Relevant legislative permitting requirements applicable to the Amakhala Emoyeni Wind Energy Facility Project EIA

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project	National Department of Environmental Affairs – lead authority. EC DEDEA - commenting authority.	This EIA report is to be submitted to the DEA and Provincial Environmental Department in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992).	National Department of Environmental Affairs EC DEDEA - commenting authority. Local authorities Local Municipality	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix M). There are noise level limits which must be adhered to. Noise impacts are expected to be associated with the construction phase of the project and are likely to present an intrusion impact to the local community. On-site activities should be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays). Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from the DEA and the Local Municipality.
National Water Act (Act No 36 of 1998)	Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation.	Department of Water Affairs	As no water use (as defined in terms of S21 of the NWA) will be associated with the proposed project, no water use permits or licenses are required to be applied for or obtained.
National Water Act (Act No	In terms of S19, the project proponent must	Department of Water Affairs (as	While no permitting or licensing

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
36 of 1998)	ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	regulator of NWA)	requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	Department of Minerals and Energy	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained.
Atmospheric Pollution Prevention Act (Act No 45 of 1965)	In terms of S27, the Minister may declare certain areas dust control areas. (The project study area has not been declared a dust control area). Part V of Act regulates pollution generated by vehicle fumes.	National Department of Environmental Affairs	Although there is no legal obligation relating to the activities to be undertaken it is suggested that best practice means should be used to prevent dust generation from the roads and excavations during construction.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	S18, S19 and S20 of the Act allow certain areas to be declared and managed as "priority areas" Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.	National Department of Environmental Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Stand alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains.	A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development. S4 of the NHRA provides that within 14 days of receipt of notification the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe a heritage resource may be affected.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	be covered by the heritage component.		
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, gathering, uprooting, damaging or destroying). Schedule 3 lists endangered flora and Schedule 4 lists protected flora. Articles 26 to 47 regulates the use of wild animals.	National Department of Environmental Affairs	Compliance requirements
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of S57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase.	National Department of Environmental Affairs	As the applicant will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies are required to be undertaken as part of the EIA process. These studies have been undertaken as part of the previously EIAs undertaken for the power station site. A specialist ecological assessment has been undertaken for the proposed project (refer to Appendix G). A permit may be required should any protected plant species on site be disturbed or destroyed as a result of the proposed development.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048.	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Weeds are described as Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.		application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be	Civil Aviation Authority (CAA)	While no permitting of licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.		
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance;	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Group IV: any electronic product; Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Road Traffic Act and the relevant Regulations.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	Local Municipality, District Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province.	Local Municipality, District Municipality	Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	» The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » The Minister may amend the list by— *(a)* adding other waste management activities to the list; *(b)* removing waste management activities from the list; or *(c)* making other changes to the particulars on the list. » In terms of the Regulations published in terms of this Act (GN 718), A Basic Assessment or Environmental Impact Assessment is required to be undertaken	National Department of Water and Environmental Affairs (hazardous waste and effluent) Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the proposed project, **no permit** is required in this regard. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMP (refer to Appendix N).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that *(a)* the containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; *(b)* adequate measures are taken to prevent accidental spillage or leaking; *(c)* the waste cannot be blown away; *(d)* nuisances such as odour, visual impacts and breeding of vectors do not arise; and *(e)* pollution of the environment and harm to health are prevented		
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements.
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested and affected parties have right to be heard	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements.

APPROACH TO UNDERTAKING THE EIA PHASE

CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an environmental management plan (EMP)) to the competent authority for decision-making. The EIA process is illustrated below:

The EIA Phase for the proposed Amakhala Emoyeni Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

4.1. Phase 1: Scoping Study

The Scoping Study, which was completed in June 2010, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Amakhala Emoyeni Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

The draft Scoping Report compiled was made available at public places for I&AP review and comment from 21 May 2010 to 21 June 2010. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were

included in the final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) and the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA) in June 2010. The Final Scoping Report was accepted by the DEA, as the competent authority. In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aims to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed Amakhala Emoyeni Wind Energy Facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Nominate preferred substation sites and power line corridors.
» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The EIA process followed for this project is described below.

4.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).

» Undertaking a public involvement process throughout the EIA process in accordance with Regulation 56 of Government Notice No R385 of 2006 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 59 of Government Notice No R385 of 2006).
» Undertaking of independent specialist studies in accordance with Regulation 33 of Government Notice No R385 of 2006.
» Preparation of this Draft EIA Report in accordance with the requirements of the Regulation 32 Government Notice No R385 of 2006.

These tasks are discussed in detail below.

4.3.1. Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and EIA report. Consultation with the regulating authorities (i.e. DEA and DEDEA has continued throughout the EIA process. On-going consultation included the following:

» Submission of a Final Scoping Report (June 2010) following a 30-day public review period (and consideration of stakeholder comments received).
» Discussions with DEA and DEDEA in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following will also be undertaken as part of this EIA process:

» Submission of a Final Environmental Impact Assessment (EIA) Report following the 30-day public review period.
» A consultation meeting with the DEA and DEDEA in order to discuss the findings and conclusions of the EIA Report.
» Provision of an opportunity for DEA and DEDEA representatives to visit and inspect the proposed site.
» Consultation with Organs of State that may have jurisdiction over the project:
  * Department of Economic Development and Environmental Affairs
  * Department of Energy
  * Department of Water Affairs
  * South African Heritage Resources Agency (SAHRA)
  * Conservation Authorities
  * Department of Transport and Public Works and various District Roads Departments
  * South African National Roads Agency
  * Department of Land Affairs

- Civil Aviation Authority
- Cacadu District Municipality
- Blue Crane Route Local Municipality

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. A record of the consultation in the EIA process is included within Appendix B.

4.3.2. Public Involvement and Consultation

The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C for a listing of recorded parties). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been ongoing for the duration of the EIA process and the project database has been updated on an on-going basis.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

» Focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local press: *The Herald* and *Somerset Budget & Pearston Advocate* newspapers)
» Written, faxed or e-mail correspondence

All registered I&APs were notified of the availability of the report and public meeting by letter. In order to facilitate comments on the draft EIA report and provide feedback of the findings of the studies undertaken, a public meeting was held prior to release of the Draft EIA Report. All interested and affected parties were invited to attend the **public feedback meeting** (held on: **7 October 2010 at the Bedford Club, from 18:00 – 20:00**).

Records of all consultation undertaken are included within Appendix E.

4.3.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to Appendix E for the Comments and Response Reports compiled from both the Scoping and EIA Phases).

The Comments and Response Reports include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

4.3.5. Assessment of Issues identified through the Scoping Process

Based on the findings of the Scoping Study, the following issues were identified as being of low significance, and therefore not requiring further investigation within the EIA:

» Potential impacts on agricultural potential

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Specialist	Area of Expertise	Appendix
David Hoare of David Hoare Consulting cc	Ecology, flora and fauna	Appendix F
Andrew Jenkins of Avisense Consulting	Avifauna	Appendix G
Iain Paton of Outeniqua Geotechnical Services cc	Geology and erosion potential	Appendix H
Lourens du Plessis of MetroGIS	Visual	Appendix J
David Halkett of the Archaeology Contracts Office, Department of Archaeology: University of Cape Town	Heritage	Appendix K
Billy de Klerk of the Albany Museum, Grahamstown	Palaeontology survey	Appendix L
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise	Appendix M
Tony Barbour (Environmental Consultant and Researcher)	Social Impact	Appendix N
Shawn Johnston of Sustainable Futures	Public involvement process	-
Bongi Siwisa of Bongi Siwisa	Public involvement process	-

Development Services

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the wind energy facility. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» The **status**, which is described as either positive, negative or neutral.
» The degree to which the impact can be reversed.
» The degree to which the impact may cause irreplaceable loss of resources.
» The degree to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

S=(E+D+M)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As Windlab Developments South Africa has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft Environmental Management Plan is included as Appendix O.

4.3.6. Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

» All information provided by Windlab Developments South Africa and I&APs to the Environmental Team was correct and valid at the time it was provided.
» It is assumed that the development site identified by Windlab Developments South Africa represents a technically suitable site for the establishment of a wind energy facility.
» Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated or offset.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

4.3.7. Public Review of Draft EIA Report

This Draft EIA **report** has been made available for public review from **18 October 2010 to 16 November 2010** at the following locations:

» www.savannahSA.com
» Bedford Library
» Cookhouse Library

Adverts were also placed in the *The Herald* and the *Somerset Budget & Pearston Advocate* newspapers.

4.3.8. Final EIA Report

The final stage in the EIA Phase will entail the capturing of responses from I&APs on the Draft EIA Report in order to refine this report. It is this final report upon which the decision-making environmental authorities (i.e. DEA) make a decision regarding the proposed project.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 5

This section of the Draft EIA Report provides a description of the environment that may be affected by the proposed Amakhala Emoyeni Wind Energy Facility located on a site between Bedford and Cookhouse in the Eastern Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data from previous studies in the area, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist scoping reports contained within Appendices F - M.

5.1 Location of the Study Area

The study area for development encompasses a surface area of approximately 273 km^2. The final footprint area to be utilised for the wind energy facility will be smaller than the area under consideration, and will be dependent on the final site layout and placement of the wind turbines. This site layout will take the wind resource and identified environmental sensitivities into account.

The proposed project site is located inland approximately 14.4 km east of the town of Cookhouse, and approximately 8.2 km south-west of the town of Bedford within the Blue Crane Route Local Municipality (Figure 5.1) of the Eastern Cape Province. The Blue Crane Route Municipality forms part of the greater Cacadu District Municipality. The study area is located to the east of the N10 national road that links Cradock to Port Elizabeth. This road runs from north to south approximately 15 km to the west of the proposed development site. The R350 route between Bedford and Grahamstown runs in a north-south direction through the eastern part of the site. The site is therefore well-connected to a number of major routes in this region.

The Poseidon Substation is ~ 700 m from the north-western boundary of the study area. A number of existing Eskom transmission and distribution power lines radiate from this point, some of which traverse the study site.

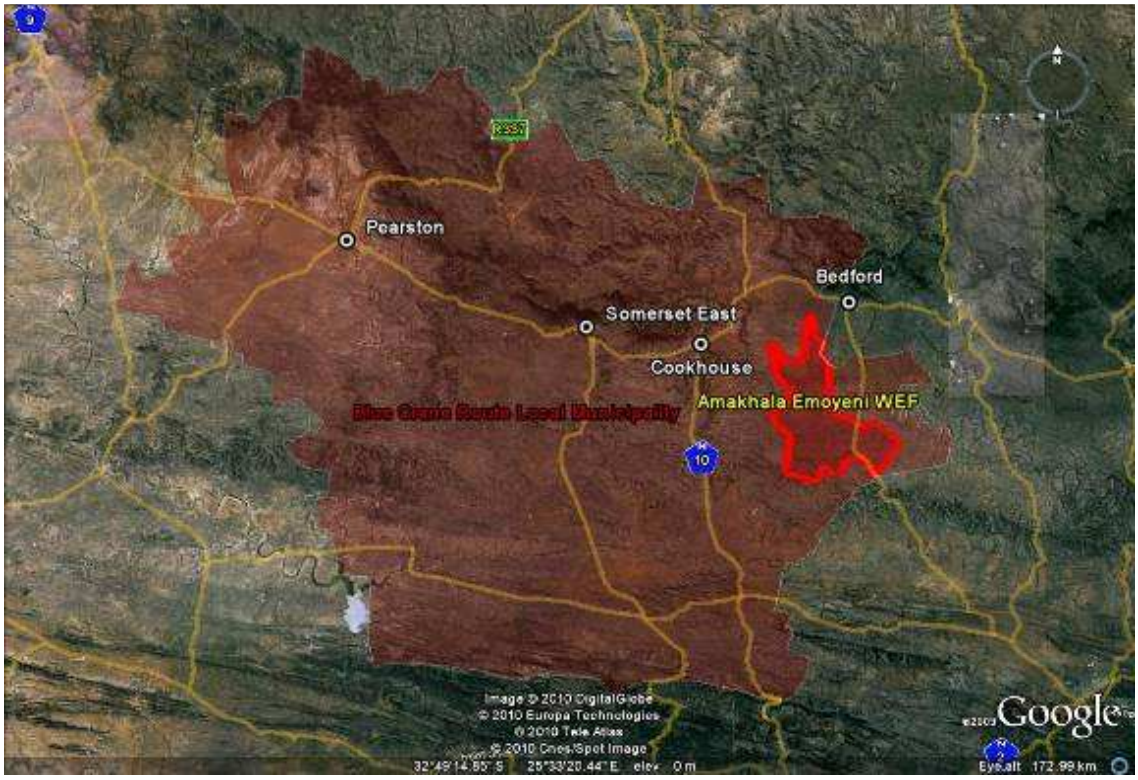


Figure 5.1: Blue Crane Route Local Municipality area indicating the approximate position of the proposed development site

The wind energy facility is proposed on the following farms:

Portion 1, 2 and remainder of Farm 222, Portion 3 of Farm 203 (Platt House), Remainder of Farm 205 (Kop Leegte), Portion 1 of Farm 206 (Normandale), Remainder of Farm 168 (Stompstaart Fontein), Remainder of Farm 224 (Taai Fontein), Remainder of Farm 221 (Leeuw Fontein), Portion 2 and remainder of Farm 223 (Paarde Kloof), Remainder of Farm 227 (Wilgem Bush), Remainder of Farm 225, Portion1, 2 and remainder of Farm 218 (Brakke Fonteyn), Remainder of Farm 259, Remainder of Farm 260, Portion 5 of Farm 149 (Great Knoffel Fonteyn), Remainder of Farm 242, Portion 1 and remainder of Farm 220 (Brak Fontein), Remainder of Farm 219 (Vogel Fonteyn), Remainder of Farm 169 (Olive Woods Estate), Portion 3 of Farm 141 (Brakfontein), Portion 1 of Farm 187 (Kleine Knoffel Fonteyn).

5.2 Climate

The study area has warm summers and mild winters. Frost is a common phenomenon and the coldest periods (usually from June to August) are exacerbated by seasonal aridity (Kopke, 1988). The average daily minima for the coldest months are below freezing. Winter frost and cold is therefore a potentially limiting factor for plant growth.

Altitude has a strong influence on most climatic variables. Generally, an increase in altitude corresponds with a decrease in temperature and an increase in rainfall. Mountains also have an orographic influence on rainfall, escarpment zones usually

experiencing increased rainfall and mists, depending on aspect, cause either an increase or decrease in mean daily insolation levels. The study site is located just south of the Amathole / Winterberg mountain range and the climate is, therefore, strongly influenced by the presence of these mountains.

Strong bimodal patterns of rainfall exist in the study area with a high proportion of spring and autumn rainfall. The mean annual rainfall in the study area is estimated to vary from approximately 340 - 500 mm for different parts of the study area (Dent et al., 1989). The areas with the lowest mean annual rainfall are in the lower-lying areas (<360 mm) and the areas with the highest rainfall are in the southern part of the study area on the south-facing slopes overlooking the river valley (> 440 mm). The mean annual rainfall on the plains, which constitutes the largest part of the study area, varies from 360 - 440 mm (Dent et al., 1989). In grasslands, all areas with less than 400 mm are considered to be arid grasslands. The study area can therefore be considered to be relatively dry and, from a floristic point of view, to represent the boundary between grassland and karroid vegetation types.

The study area has high lightning flash densities, which makes the incidence of lightning-induced fire a high likelihood (Schulze, 1984). The Eastern Cape is considered to be one of the windiest parts of South Africa (Kopke, 1988). Persistent north-westerly winds occur throughout the year bringing dry heat. This can have a severe desiccating effect on the vegetation in any aspects exposed to this wind. In contrast, cold, moist, south-easterly winds blow occasionally in summer. Northerlies, mostly in summer, bring thunderstorms by advecting moist tropical air. Cold fronts, mostly in winter, bring cold, sometimes dry winds.

5.3 Regional Setting

Sheep farming dominates the general land-use character of the region within which the study area is located. Irrigated agricultural fields occur along the Great Fish River that winds its way through the study area. The region has a population density of less than 10 people per km^2 with the highest concentrations occurring at the towns of Cookhouse, Bedford and Adelaide. The study area has a rural character with farming homesteads dotting the countryside at irregular intervals. Exceptions occur where power lines (entering/exiting at the Eskom Poseidon Substation) traverse the study area. The Pembroke-Poseidon-1 and Neptune-Poseidon-1 transmission lines, as well as the Poseidon-Glenden-1 and Poseidon-Albany-1 distribution lines traverse the proposed development site. The high concentration of power lines within the study area accounts for a considerable amount of visual disturbance (resulting from these structures with height) within close proximity of the proposed site.

Natural vegetation, in the form of Thicket and Bushland and Shrubland covers the largest part of the study area, while the mountainous terrain to the north predominantly consists of Natural Grassland. The quality of these natural vegetation types ranges from

virtually pristine in the northern mountainous sections of the study area, to degraded and overgrazed in the centre of the study area.

The dominant topographical unit or terrain type of the study area comprise hills and lowlands to the centre of the study area, and low mountains to the north and to the south. The core area earmarked for the development of the facility is located on a distinct plateau (table land) located in the centre of the study area. The mountains in the northern section of the study area are the southern foothills of the Winterberge mountain range, which forms part of the mountains of the great escarpment. The Great Fish River, Baviaans River, Cowie River and Koonap River account for the main hydrological features within this region.

Three private game farms/reserves are located south of the proposed development site. These are the Doorn Boom Game Farm, the East Cape Game Farm and the Woodlands Game Reserve (refer to Figure 5.2).

5.4 Social Characteristics of the Study Area

5.4.1 Demographic Profile

The population the Blue Crane Route Municipality is estimated at 36 798 (based on a household survey conducted by the Cacadu District Municipality in 2005). The population constitutes approximately 7.21% of the greater Cacadu District. The average population growth is estimated at 1.7% which will translate in a total population of 39 956 in 2010. Almost a third of the population (~26%) live in rural villages, homesteads and settlements while the remaining population resides in the three urban nodes. Given the size of the Municipality and the relatively small total population size, the population density within the Municipality is low.

The age profile of the population reveals that approximately 64.2% of the population is potentially economically active falling between the 15 to 65 year old age bracket.

5.4.2 Economic Profile

Economically, the Blue Crane Route Municipality contributed approximately 17% of the greater district's local economy in 2004. The largest contributing sectors within the Municipality in 2004 were Transport and Communication (~26%), General Government Services (~18%) and Manufacturing (~13%).

While agriculture and fishing contribute only ~11% of the Gross Geographic Product (GGP), it employs ~36% of the employed population within the Municipality. This is largely a consequence of widespread subsistence farming in the area. Community Services employs ~22% of the employed population. The Transport and

Communications sector, while contributing ~26% to GGP only employs less than 1% of the employed population.

Unemployment within the Municipality is estimated at 26.3%, which in below the Eastern Cape average of ~32%, while 41.8% of the population is not economically active. The latter is primarily made up of scholars/students, pensioners, as well as those that could not find work (~50%).

5.5. Biophysical Characteristics of the Study Area and Surrounds

5.5.1 Geographical Profile

A general view of the topography of the study area is given in Figure 5.2. The proposed development site is located on the plains just to the south of a mountain range. The Winterberg Mountains run in an east-west direction in this area, although the southern faces contain numerous valleys that run perpendicular to the main mountain chain. The Great Fish River cuts through the mountains just to the north of the study area and has also created a rugged landscape adjacent to it where it has cut into the plains. The study site is situated on the upland part of the plains adjacent to this river valley.

The study area is gently to moderately sloping across the plains and more steeply sloping in the areas surrounding the river valley. The site of the proposed wind energy facility is on the flat plains south and south-west of Bedford quite close to the edge of the scarp slope that drops into the river valley.

There are small patches of the study area, primarily in close proximity to the main drainage lines, that have been cultivated. The majority of the study area is natural, although parts have been degraded to varying degrees through land-use practices such as natural grazing of livestock. The landscape consists primarily of farms used as rangeland for commercial livestock production (Figure 5.3). Commercial farming systems are characterised by land stocked at economically sustainable levels. These regions have been commercially farmed as stock ranches for close to 100 years. Degradation of grasslands, including the spread of karroid shrublands into the Grassland Biome, has been blamed on high stocking rates of domestic livestock in commercial farming areas. The study area is no exception and degradation due to overgrazing is evident in the amount and type of vegetation cover on the site.

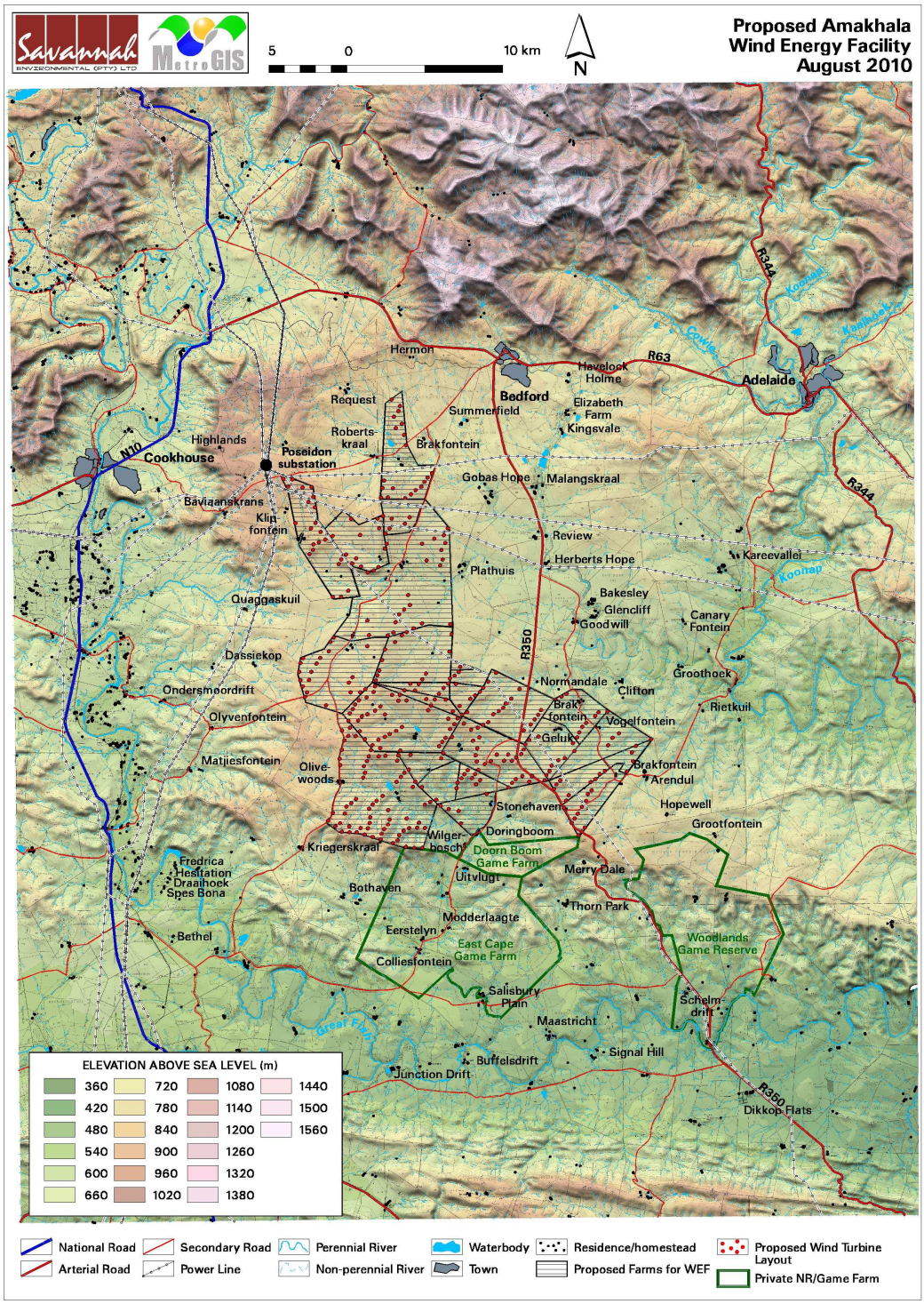


Figure 5.2. Shaded relief map of the broader study area illustrating the changes in topography and elevation above sea level across the site and surrounding area

Figure 5.3: Land cover/land use map of the broader study area (data from the Surveyor General, and not mapped)

5.5.2 Geomorphology and geology in the Study Area

The Graaff-Reinet and King Williamstown 1:250 000 Geological maps indicate that the study area is underlain by Permian Balfour and Middleton Formations of sedimentary rocks (Adelaide Subgroup - Beaufort group – Karoo Supergroup). These two formations

typically have very similar lithology. Both formations consist of essentially greenish (or blueish) grey and greyish-red mudstones and sandstones.

Intrusive rocks are limited to minor exposures of transgressive dolerite sills of Jurassic age in the northern and southern portions of the study area.

Rock outcrops or very shallow rock occurs over approximately 60% of the study area, specifically on the upland areas and areas of moderate to high relief. The hardness of the various rock types acts as a control on the development of the landscape. The hard, resistant dolerite has aided the preservation of prominent hills in the area from the forces of erosion which attempt to level the landscape. The sandstone units within the Middleton and Balfour Formations are coarser grained, harder and less prone to weathering than the mudstones. Hard sandstone layers produce resistant ledges and cliffs and the mudstones typically crumble on steep slopes (slaking), producing concave cliff-faces and slopes. Soft argillaceous rocks (mudstones) are also more susceptible to chemical weathering. Natural drainage lines also tend to develop in weaker rocks types, fractures or fault lines.

Soil type, texture and thickness are generally controlled by the parent rock type, topography and climate of the area. Soil thickness will be affected by erosional processes on steep slopes and depositional processes on low-lying areas of low relief. Soils on steep slopes are generally restricted to thin, coarse-grained transported soils (talus gravel deposits). On low relief terrain, the deposition of thicker, finer accumulations of transported soil (hillwash and colluvium) is common and this also aides the formation of residual soils, which are formed by the chemical weathering of the parent rock.

Observations made at the proposed sites of the individual turbines, which are generally planned on the upland areas of low relief, suggest that shallow rock exists over most of the sites and the transported soil horizon is generally, particularly in the southern region. The development of residual soil is likely to be limited to low-lying areas.

5.5.3 Ecological Profile

According to the most recent vegetation map of the country (Mucina and Rutherford, 2006), the study area falls within two main vegetation types, i.e. Bedford Dry Grassland and Great Fish Thicket. The vegetation types have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in Table 5.1 below, as determined by best available scientific approaches (Driver et al., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al., 2005).

Table 5.1: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Both of the vegetation types occurring in the study area are classified as Least Threatened on the basis of rates of transformation and conservation (Driver et al., 2005; Mucina et al., 2006). In both of these vegetation types, the amount of transformation is relatively low. The rates of conservation are not very high, but most of these vegetation types are utilised in their natural state to support commercial livestock farming and there is no immediate threat of them becoming transformed to another landcover type in which natural vegetation is not supported. Despite low levels of transformation, rates of degradation may be relatively high.

Table 5.2: Conservation status of different vegetation types occurring in the study area (according to Driver et al. 2005 and Mucina et al. 2005)

Vegetation Type	**Target (%)**	**Conserved (%)**	**Transformed (%)**	**Conservation status**
Bedford Dry Grassland	23	1	3	Least Threatened
Great Fish Thicket	19	11	4	Least Threatened

Beford Dry Grassland is considered to be *Least Threatened*, with 1% conserved of a target of 23% and 3% transformed (Mucina et al., 2006). This vegetation type is found on the gently undulating plains south of the Winterberg Mountains from Somerset East in the west to Fort Beaufort in the east. It is an open, dry grassland interspersed with *Acacia karroo* woodland, especially along drainage lines. The grassland is relatively short and contains a dwarf shrubby component of karroid origin. This is the most widespread vegetation type within the study area and occurs on all the farm portions under assessment (refer to Figure 5.4).

Great Fish Thicket is considered to be *Least Threatened*, with 11% conserved of a target of 19% and 4% transformed (Hoare et al. 2006). This vegetation type occurs mainly in the lower Great Fish River and Keiskamma River valleys, extending up the Great Fish River to Cookhouse and into the southern-most part of the Cradock District. It is found on the steep slopes of deeply dissected rivers. The vegetation is a short, medium or tall thicket. Woody trees and shrubs and succulents are common to dominant and there are many spinescent shrubs. This vegetation type is found along the steep slopes on the

western side of the study area overlooking the Great Fish River and is the dominant vegetation type in at least one of the farm portions under assessment (refer to Figure 5.4).

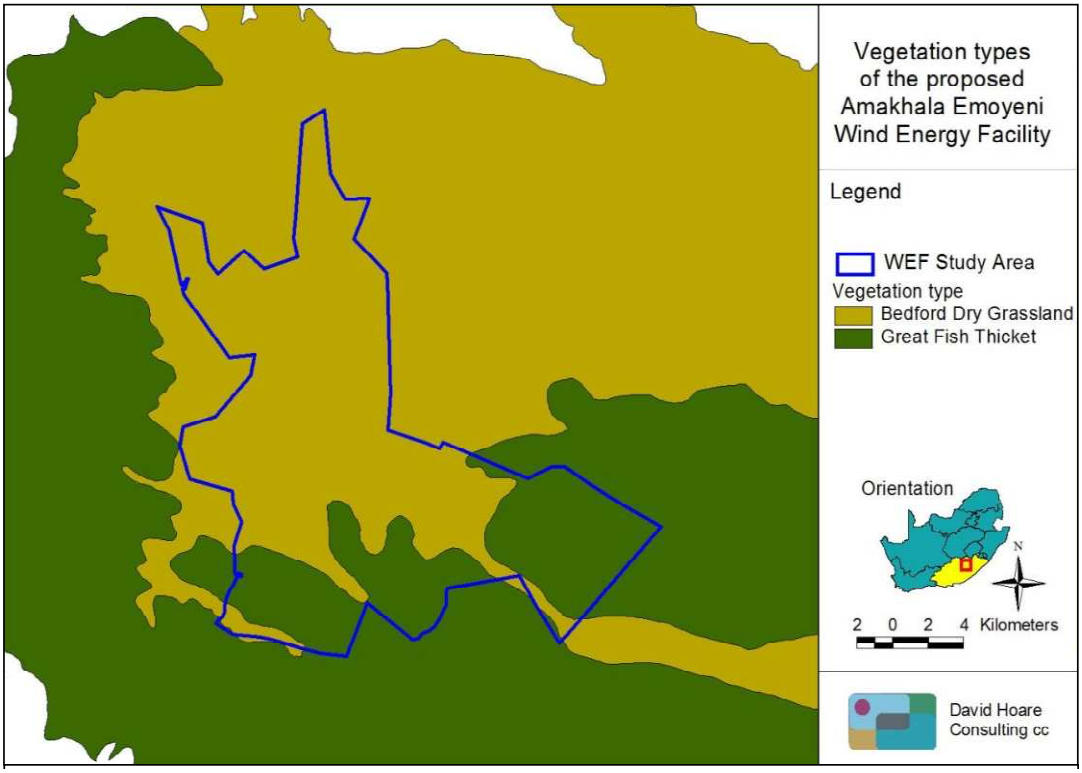


Figure 5.4: Image of the site showing property boundaries (in black) and the broad vegetation types occurring in the area

The site contains a number of non-perennial drainage lines and watercourses (Figure 5.5). These drain into more significant riparian areas, some of which may contain flowing water for significant parts of the year. The watercourses and riparian zones are often dry with a sandy or rocky bed, but there are also grassy watercourses and seepage areas in upper reaches.

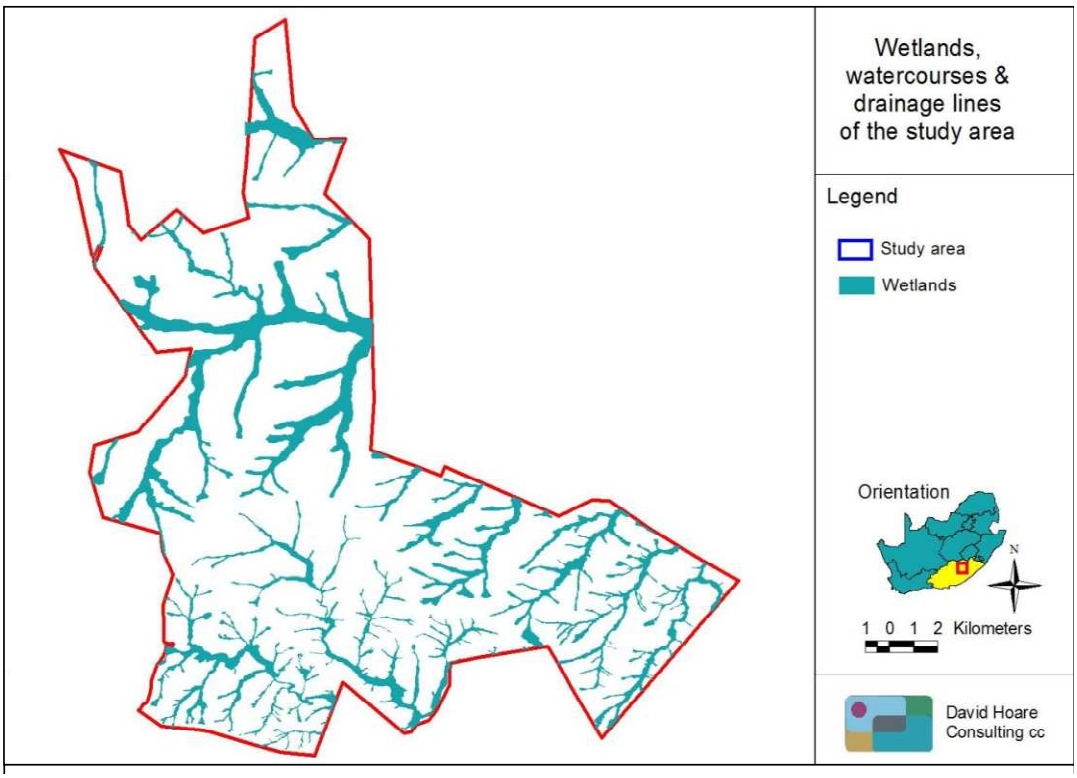


Figure 5.5: Riparian areas, watercourses and wetlands on site.

Red List plant species of the study area

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1 of the Ecology EIA report (Appendix F). The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were four species recorded in the quarter degree grids that are listed on the Red List that could occur in habitats that are available in the study area. One of these is listed as *Near Threatened*, one as *Declining* and two as *Rare*. The Near Threatened species is *Encephalartos lehmannii* (Karoo cycad). This species is found in arid low succulent shrubland on rocky ridges and slopes. Its overall distribution is concurrent with Albany Thicket. It has been recorded twice within the grids in which the study area is located. The likely distribution of this species is probably to the west of the site in the thicket areas that overlook the Great Fish River Valley or in the thicket areas in the southern parts of the site, especially in rocky areas.

Red List animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 2 of the Ecology EIA report (Appendix F). Those vertebrate species with a geographical distribution that includes the study area and habitat preference that includes habitats available in the study area are discussed further below.

There are nine mammal species of conservation concern, including one species classified as *Endangered*, that could occur in available habitats in the study area. The endangered species is the White-tailed Rat, which occurs in Highveld and montane grassland, but requires sandy soils with good cover. The soils on the site are likely to be clay, although more sandy soils could occur in drainage lines. There are four near threatened bat species that could occur on site, the Lesser Wooly Bat, Lesser Long-fingered Bat, Geoffroy's Horseshoe Bat and Cape Horseshoe Bat. Only the Lesser Woolly Bat was assessed as having a high chance of occurring on site, as noted in historical records. The remaining mammal species were assessed as having a low chance of occurring in available habitats in the study area or the study site is at the margin of their distribution range. There is one threatened frog species previously recorded in the grids in which the study area is located and which could occur on site. There is one threatened reptile species that has a distribution that includes the study area and which could also occur on site.

Avifauna in the study area

The study area is not located close to any recognised national Important Bird Areas, but is likely to support a diverse avifauna, including some important populations of rare, threatened and/or endemic species. At least 282 bird species could occur with some regularity within the anticipated impact zone of the wind energy facility, including 70 endemic or near-endemic species, 16 red-listed species, and four species – Ludwig's Bustard, Blue Crane, Black Harrier and Melodius Lark– which are endemic and red-listed.

The birds of greatest potential relevance and importance in terms of the possible impacts of the proposed wind energy facility are likely to be:

» Erratic incursions and/or seasonal influxes of non-breeding Cape Vulture, drawn down from higher lying areas to the north-east to feed on stock. Cape Vulture numbers in South Africa have been decreasing steadily over the last century, and more sharply in recent decades, and the species is classed as both nationally and globally 'Vulnerable'. This decline has been particularly evident in the Eastern Cape, at least partly because of high mortality rates caused by collisions with overhead lines. It seems likely that the birds which visit the broader Cookhouse area are from an established roost at "Agieskloof", some 10 km to the north-east. This is believed to be mainly a summer roost, used by up to 120 birds in the off-season, and much depleted in the winter (from Feb-March to Sept-Oct) when most of these birds move east to breed. Cape Vultures may be attracted to the development area by the combination of open, grassy slopes with good slope soaring conditions, small stock farming with heavy losses associated with drought and/or lambing and carcasses left where they fall, and convenient lines of power line pylons to provide safe perch/roost sites.
» Flocks or breeding pairs of Blue Crane, resident and/or seasonal influxes of Denham's Bustard and White-bellied Korhaan, and possibly seasonal influxes of Ludwig's

Bustard. These are all Red-listed, collision prone and possibly displacement prone species.

» A range of locally resident or visiting raptors (including Black Harrier, Martial Eagle, Secretarybird Sagitarrius serpentarius, Lesser Kestrel Falco naumanni and Lanner Falcon F. biarmicus) foraging in or moving through the area. These are all collision and possibly displacement prone species, likely to use ridges occupied by wind turbines as sources of slope lift.
» A suite of restricted range endemic passerines, including Melodius Lark, possibly susceptible to loss of habitat and/or displacement from the area by the development of the wind energy facility.

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3 of the Ecology EIA report (Appendix F). Those that have a geographical distribution that includes the study area are *Catha edulis, Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius*, *Prunus africana and Sideroxylon inerme* subsp. *inerme*.

Catha edulis is found in evergreen forest, often in rocky places. *Curtisia dentata* occurs in coastal and montane forest. *Ocotea bullata* occurs in montane forest. *Pittosporum viridiflorum* occurs along forest margins, in bush-clumps and in bushveld, often in rocky outcrops. *Podocarpus falcatus* is found in Afromontane forest. *Podocarpus latifolius* is found in coastal and Afromontane forest. *Prunus africana* occurs in montane forest, usually in mistbelt areas. *Sideroxylon inerme* subsp. *inerme* usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld.

None of these species was seen on site, but the size of the area and the fact that some species may occur as small individuals amongst other plants indicates that there is still a very small possibility that they may occur on site. *Pittosporum viridiflorum* could occur in any dense woodland in the study area, especially with any thicket vegetation that may occur in the southern parts of the study area, although no especially dense areas of thicket were encountered. *Catha edulis* has been previously recorded in the study area. T species is most likely to occur in the forested areas to the north of Bedford, which means it is unlikely to occur on site.

5.5.4 Nature conservation in the vicinity of the proposed facility

There have been a number of regional conservation assessments produced within the Eastern Cape Province, including the following:

» Subtropical Thicket Ecosystem Programme (STEP)
» Succulent Karoo Ecosystems Programme (SKEP)
» National Spatial Biodiversity Assessment (NSBA)
» Eastern Cape Biodiversity Conservation Plan (ECBCP).

These studies identify patterns and processes that are important for maintaining biodiversity in the region. Unfortunately, many of these studies have been done using coarse scale satellite imagery that does not provide spatial or spectral accuracy at the scale of the present study. They are, however, useful for understanding broad issues and patterns within the area. The ECBCP has integrated all previous studies and is a useful reference for identifying conservation issues in the study area and surrounds.

The ECBCP identifies Critical Biodiversity Areas (CBAs), which are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (Berliner and Desmet, 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows (for the study area and surroundings):

» PA: Protected areas.
» CBA 1: Critically endangered vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
» CBA 2: Endangered vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
» CBA 3: Vulnerable vegetation types.

Within and around the study area, the ECBCP identifies CBAs at one level that occurs within the study area (refer to Figure 5.6). The CBA 2 areas that fall within the southern portions of the study area are corridor areas, which are important for a number of reasons, including the maintenance of ecological processes.

The study site occurs within the Albany Centre of Floristic Endemism. Moreover, it is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation. Thicket is the most conspicuous component of this Centre and there is a high degree of endemism amongst succulent plants in this Centre of Endemism. It may be presumed that assessments of vegetation types and species in the sections above will also address components that would be important for the Albany Centre of Endemism, but ensuring that no endemic elements of the Albany Centre are negatively affected is also important.

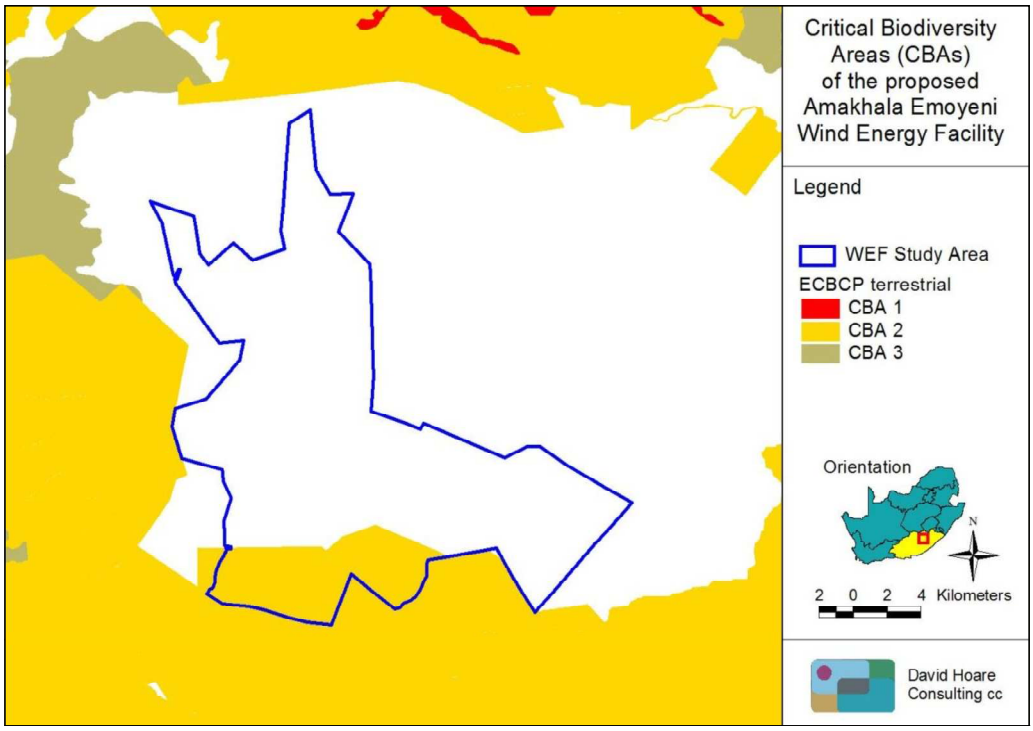


Figure 5.6: Important Biodiversity Areas occurring on the project development site and the broader study area

5.5.5 Agricultural Potential

Very little of the area contains high potential soils and only one land type occurring in a small portion in the northwest area of the proposed site contains a significant proportion of moderate potential soils.

Much of the study area consists of either shallow lithosols of low potential, structured, clay soils of low to moderate potential or rock.

The area under investigation is covered by six land types, as shown on the map below, namely:

» Db167 (Non-red duplex soils)
» Fc169 (Shallow soils, usually calcareous)
» Fc534 (Shallow soils, usually calcareous)
» Fc537 (Shallow soils, usually calcareous)
» Fc545 (Shallow soils, usually calcareous)
» Fc546 (Shallow soils, usually calcareous)

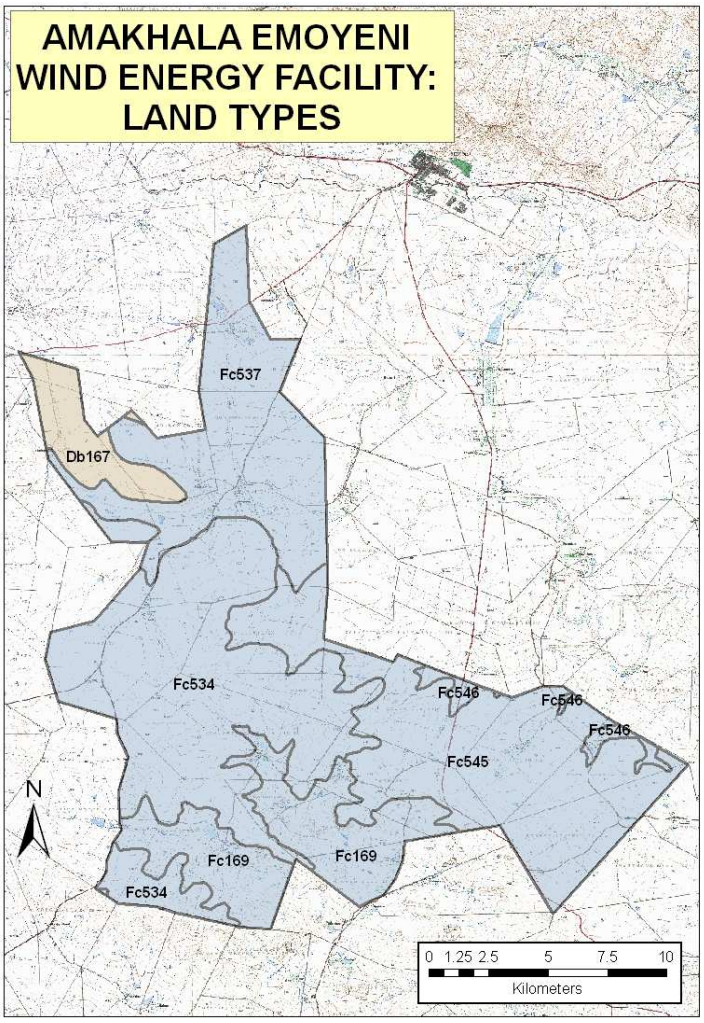


Figure 5.7: Land types characteristic of the wind energy facility site

There are almost no signs of any arable agriculture on the site, with only a very few small fields next to some of the streams that flow through the area. However, the low rainfall in the vicinity means that there is little potential for arable agriculture in the area and that the soils are suited for extensive grazing at best. The grazing capacity of the area is moderately low, around 12-18 ha/large stock unit (ARC-ISCW, 2004).

5.5.6 Heritage Profile

The study area contains material dating to the Early Stone Age and Middle Stone Age (3 million – 20 000 years ago). This material is often observed in eroded areas, or on terraces in river valleys. Later Stone Age sites attributable to the ancestors of the San people and later Khoekhoen pastoralists (after 2000 years ago) are also present within the study area. The San frequented both the Karoo and the coastal plains. Their legacy includes numerous open sites while traces of their presence can be found in most large rock shelters, often in the form of rock paintings.

Pre-colonial archaeology from the Holocene and Pleistocene periods exists in the area and could be impacted by the proposed activity. Diffuse and isolated scatters of stone artefacts were observed on a number of farms. In general, many appear to be of Middle and/or Early Stone Age date. A number of Later Stone Age sites were also recorded. The majority of these sites are of low significance but a smaller number would require mitigation if they were to be disturbed by proposed activities.

Some colonial period heritage is found within the boundaries of the study area, as it is known that this area has been subject to European settlement since possibly before the 19th century. The fact that most of the farms that make up the study area were formalised under British colonial rule in the early 19th century indicates a high likelihood of structures relating to this time or later.

Historical features, buildings and graveyards associated with farms are also present within the study area. Preliminary historical research has indicated that farms in the area were granted in the early 19th century to Dutch speaking farmers and buildings of this period are present on the site. A number of structures are clearly older than 60 years and are therefore protected by the National Heritage Resources Act (Act 25 of 1999).

5.5.7 Paleontological Profile

The study area is underlain by sediments of the lower Beaufort Group, Karoo Supergroup. The succession of sediments increases in age from c. 260Ma in the south to 255Ma in the north. These sediments were laid down by ancient river systems that were flowing from south toward the north and preserve a variety of fossil organisms of this time from therapsids (mammal-like reptiles), amphibians, fishes, freshwater invertebrates (mainly bivalves) and plants.

The Beaufort Group sediments are subdivided into eight biozones on the basis of the vertebrate fossil assemblages found in each zone. To date the exact boundaries between individual biozones in this area have not been well defined because of a paucity of outcrops and hence the low number of identifiable fossils that have been collected in the past.

The predominantly terrestrial sediments of the Beaufort Group have, throughout South Africa, yielded a large number of vertebrate fossils in the form of amphibians, early primitive reptiles (the captorhinids), mammal like reptiles (therapsids), and fish. Minor freshwater invertebrates (molluscs) and plant fossils have also been recovered. For the most part however, the fossils found in the Beaufort sediments are rare – particularly in the lowermost part of the succession.

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE CHAPTER 6

Windlab Developments South Africa Pty Ltd is proposing to establish a commercial wind energy facility on a site between Cookhouse and Bedford in the Eastern Cape Province. It is proposed for a cluster of up to 350 wind turbines (described as a wind energy facility or a wind farm) to be constructed over an area of approximately 273 km^2 in extent.

The construction activities for a wind energy facility project include land clearing for site preparation and access/haul roads; transportation of supply materials and fuels; construction of foundations involving excavations and cement pouring; compaction of laydown areas and roadways, manoeuvring and operating cranes for unloading and installation of equipment; laying cabling; and commissioning of new equipment. Decommissioning activities may include removal of the temporary project infrastructure and site rehabilitation. Environmental issues associated with these **construction** and **decommissioning** activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to wildlife through mortality, injury and disturbance; impacts to sites of heritage value; soil erosion; and nuisance noise from the movement of vehicles transporting equipment and materials during construction.

Environmental issues specific to the **operation** of a wind energy facility include visual impacts; noise produced by the spinning of rotor blades; avian/bat mortality resulting from collisions with blades; and light and illumination issues.

These and other environmental issues were identified through the scoping evaluation. Potentially significant impacts identified have now been assessed within the EIA phase of the study. The EIA process has involved input from specialist consultants, the project proponent, as well as input from key stakeholders (including government authorities) and interested and affected parties engaged through the public consultation process. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts vary significantly from site to site.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed **wind turbines and associated infrastructure** (substations, power lines, access road to the site, internal access roads between turbines, underground electrical cabling between turbines, turbine foundations), and to make recommendations regarding preferred alternatives for consideration by DEA, as well as for the management of the impacts for inclusion in the draft Environmental Management Plan (refer to Appendix O).

6.1. Assessment of Potential Impacts – overarching methodology

In order to assess the impacts associated with the proposed wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A study area of approximately 273 km^2 is being considered as a larger study area for the construction of the proposed wind energy facility. From the results of the facility layout determination exercise, it is now apparent that the effective utilised area required to accommodate the infrastructure is in fact approximately 100 ha in extent. This area to be occupied by turbine and associated infrastructure is illustrated in Figure 6.1 below, and would include:

» Up to **350 wind turbines**.
» **Foundations** (of up to 15 x 15 x 2 m) to support the turbine towers
» **Underground cables** (where practical) between the turbines.
» Up to 3 **substations** (each of up to 250 x 200 m, two 33/132kV substations and one 33/132/220/400 kV substation) to facilitate the connections between the wind energy facility and the Poseidon substation.
» Internal **access roads** to each turbine (4 - 6 m wide during construction, reduced to 3 – 4 m wide during operation).
» Two new sections of 132kV overhead **power lines** and one new section of 33/132/220/400kV power line feeding into the Poseidon substation.
» Possible on-site maintenance facility and visitor centre

Three separate power lines are proposed to connect the three substations in the facility to the existing Eskom Poseidon (refer to Figure 6.1). The power lines are restricted to the site footprint itself without traversing any adjacent land therefore **no alternative power line routes/corridors** are being considered through the EIA. The sensitivity of the proposed routes for the power lines and proposed substation positions are assessed through this EIA report.

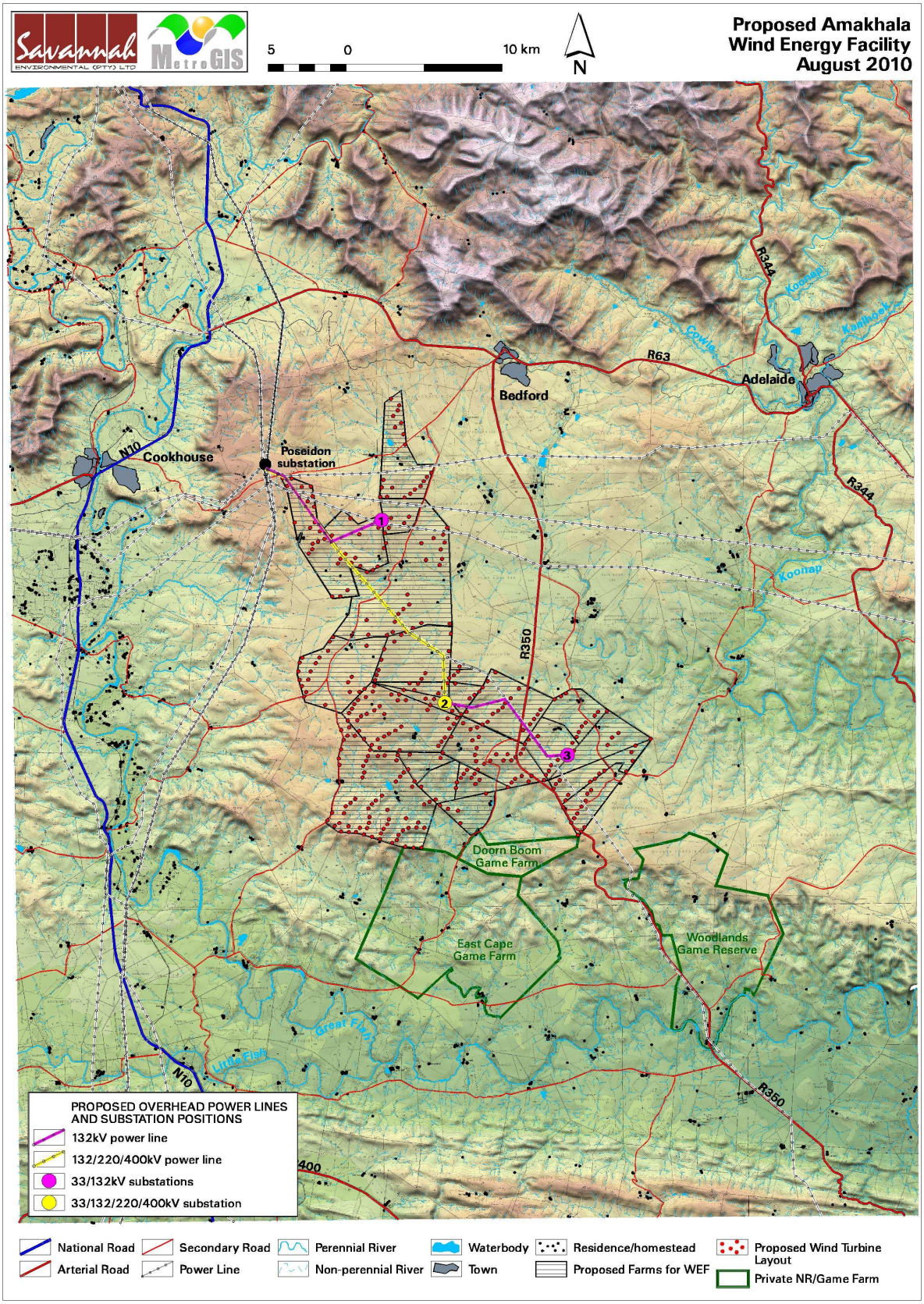


Figure 6.1: Locality map showing provisional wind turbine layout, power line corridors and substation sites

In order to assess the areas where impacts could occur on the site, a site layout optimisation exercise revealed the best possible positions for the turbines, substations and other infrastructure from a technical perspective.

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation phases of the proposed wind energy facility on the identified site. Issues were assessed in terms of the criteria as detailed in Chapter 4 (with the scores as per the significance methodology provided in brackets). Potential direct and indirect impacts of the proposed wind energy facility are assessed, and recommendations are made regarding mitigation and management measures for potentially significant impacts.

6.2. Assessment of Potential Impacts on Ecology

Major potential impacts on ecology are described briefly below. There are two major ways that a wind energy development may influence ecosystem structure and functioning: a) through direct impacts on individual organisms and b) through impacts on habitat structure and functioning.

Areas containing untransformed natural vegetation, high diversity or habitat complexity, organisms of conservation concern or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. A map of sensitive areas is shown in Figure 6.2. Broad scale mapping was used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

» Vegetation of conservation importance: this is based primarily on the Eastern Cape Biodiversity Conservation Plan;
» Perennial and non-perennial rivers and streams: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
» Potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a high chance of occurring within remaining natural habitats within the study area.

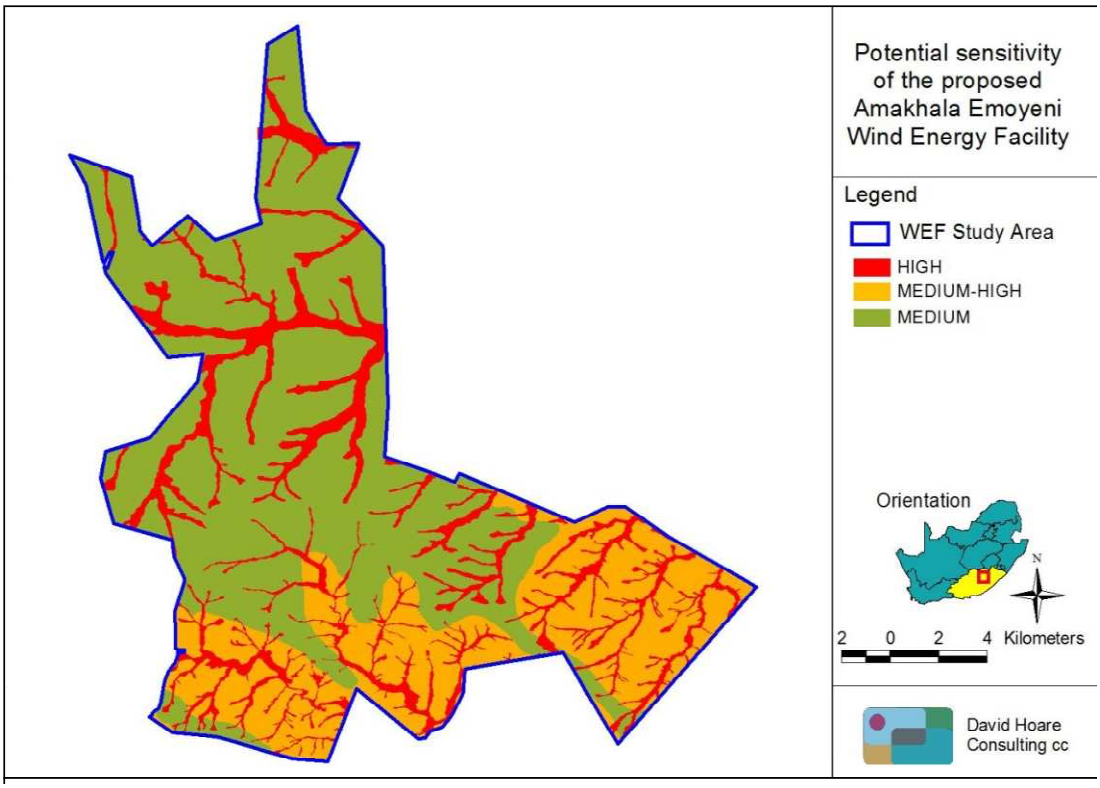


Figure 6.2: Map indicating the sensitive ecological areas in the study area

The major potential impacts are described briefly below.

» **Impacts on bat species**

Bird and bat deaths are one of the most controversial biological issues related to wind turbines. The deaths of birds and bats at wind energy facility sites have raised concerns by conservation agencies internationally. Potential impacts on birds are discussed in detail in Section 6.3 below.

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage the bat's lungs). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species.

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is

unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that coincides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on.

It has been evaluated that there are no bat species of conservation concern that could potentially be affected by the proposed wind energy facility. This impact is therefore not evaluated further.

» **Impacts on threatened animals**

Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

- fragmentation of populations of affected species;
- reduction in area of occupancy of affected species; and
- loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

It has been evaluated that there is one mammal species of conservation concern, classified as Endangered, and one protected frog species that could potentially be affected by the proposed wind energy facility. Neither is considered to have a high chance of occurring on site.

The Endangered mammal species is the White-tailed Rat, which occurs in Highveld and montane grassland, but requires sandy soils with good cover. Geological information indicates that soils on site are likely to be clay, although more sandy soils could occur in drainage lines. This reflects patterns observed on site. Furthermore, habitat information collected in the field indicates that grassland habitat suitable for this species does not occur on site. It is therefore

considered unlikely that this species occurs on site. Impacts on this species are, therefore, not considered further.

There is one frog species of conservation concern previously recorded in the grids in which the study area is located and which could occur on site. This is the Giant Bullfrog. This species was previously listed as Near Threatened, but is now listed as Least Concern. It is, however, protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). It inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas. It also utilises non-permanent vleis and shallow water on margins of waterholes and dams. It prefers sandy substrates although they sometimes inhabit clay soils. There are some farm dams in watercourses that could potentially provide breeding habitat for this species, although not ideal. Bullfrogs could forage in surrounding vegetation.

» **Impacts on threatened plants**

Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

- fragmentation of populations of affected species;
- reduction in area of occupancy of affected species; and
- loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances. There is one plant species of conservation concern that has a geographic distribution that includes the site and two species of lesser conservation concern. The plant species of concern is the Karoo cycad, classified as Near Threatened. This species is only likely to occur in rocky areas within thicket vegetation, which occurs in the southern part of the site.

» **Impacts on protected tree species**

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section1 5(1) of the National Forests Act, 1998 "no

person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated".

A number of species have a geographic distribution that includes the study area appear on this list however they all occur primarily in forest habitat, which does not occur on site. It is therefore not considered likely that they occur on site. This impact is therefore considered unlikely to occur and is not evaluated further. Nevertheless, if in the unlikely event that any protected trees are found on site, a permit would need to be obtained for any trees that are affected, so a legal obligation remains irrespective of the significance of the impact.

» **Impacts on indigenous natural vegetation (terrestrial)**

Construction of infrastructure may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of grassland vegetation. Where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). Consequences of the impact occurring may include:

- negative change in conservation status of habitat;
- increased vulnerability of remaining portions to future disturbance (reduced resilience);
- general loss of habitat for sensitive species;
- loss in variation within sensitive habitats due to loss of portions of it;
- general reduction in biodiversity;
- increased fragmentation (depending on location of impact);
- disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- loss of ecosystem goods and services.

» **Impacts on wetlands**

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. This will lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

- increased loss of soil;

- loss of or disturbance to indigenous wetland vegetation;
- loss of sensitive wetland habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
- fragmentation of sensitive habitats;
- impairment of wetland function;
- change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
- reduction in water quality in wetlands downstream of road.

The site contains a number of wetlands, watercourses and drainage lines. There are a small number of (6 identified) turbines that appear to be located within these areas, but there is a high likelihood that underground cables and internal access roads will be required to traverse, and potentially affect these areas.

» **Change in runoff and drainage patterns**

Infrastructure and roads crossing landscapes cause local hydrological and erosion effects resulting in major peak-flow and sediment impacts (Forman & Alexander 1998). This may occur around construction sites, but also in areas where the infiltration rates of the landscape are changed due to an impermeable surface being constructed. Increased runoff associated with infrastructure may increase the rates and extent of erosion, reduce percolation and aquifer recharge rates, alter channel morphology and increase stream discharge rates. Consequences may include:

- increased loss of soil;
- loss of or disturbance to indigenous vegetation, especially in wetlands;
- loss of sensitive habitats, especially in wetlands;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- fragmentation of sensitive habitats;
- impairment of wetland function;
- change in channel morphology in downstream wetlands, potentially leading to loss of wetland vegetation; and
- reduction in water quality in wetlands downstream of disturbance.

» **Establishment and spread of declared weeds and alien invader plants**

Major factors contributing to invasion by alien invader plants includes high disturbance and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away. Consequences of this may include:

- loss of indigenous vegetation;
- change in vegetation structure leading to change in various habitat characteristics;

- change in plant species composition;
- change in soil chemical properties;
- loss of sensitive habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- fragmentation of sensitive habitats;
- change in flammability of vegetation, depending on alien species;
- hydrological impacts due to increased transpiration and runoff; and
- impairment of wetland function.

The site does not currently harbour alien plants in significant densities. There are localised concentrations of Eucalyptus around homesteads and other species that occur sporadically in the landscape. Alien invasions are therefore not a major issue in the study area at the moment, but the presence of a diffuse disturbance over a wide area could lead to the spread of a number of species that are present in the area. The habitats most likely to be affected are watercourses and grasslands.

There are two major vegetation types that occur in the study area, namely Bedford Dry Grassland and Great Fish Thicket (both classified as Least Threatened). Most of the study area is is still in natural condition, although parts are degraded due to commercial livestock farming. Taking rates of transformation and conservation into account, which have already been used to classify all national vegetation types, none of the vegetation in the study area is considered to be threatened. However, the thicket in the study area has been classified in the Succulent Thicket Ecosystems Programme as having elevated conservation value and, for that reason, has been classified here as having high sensitivity. This is consistent with the treatment of these areas in the Eastern Cape Biodiversity Conservation Plan, where these areas are classified as sensitive and part of an ecological corridor region.

Other factors that may lead to parts of the study area having high ecological sensitivity are the presence of watercourses and wetlands within the shallow drainage lines on site and the potential presence of a small number of plant and animal species of conservation concern.

Other than protected ecosystems and threatened plant and animal species, wetlands are protected under national legislation (National Wetlands Act). Any impacts on these areas would require a permit from the relevant National Department.

There are eight tree species that are protected under the National Forests Act that have a geographic distribution that includes this area. It has been

determined during the field survey that forest does not occur on site and these protected tree species are unlikely to occur on site.

There is one plant species of conservation concern that could occur in available habitats in the study area. This is the Near Threatened Karoo cycad. It is considered that there is a low probability of encountering this plant species on site. Although there is suitable habitat, the plant was last recorded in 1964 on site and, in all likelihood, has already been removed from the site by collectors.

There is a single animal species of conservation concern that may occur in habitats within the study area, the near threatened Giant Bullfrog. Likely breeding sites are the edges of small farm dams in watercourses on site. They may forage in surrounding vegetation.

Impacts are assessed below for each component of infrastructure for the proposed wind energy facility, as follows:

» wind turbines;
» internal substations;
» overhead power lines (132kV and 400kV);
» underground cables between turbines and linking turbines to internal substations;
» internal access roads.

Underground cables linking turbines and internal access roads are expected to generally follow the same alignment. The two components of the infrastructure are therefore assessed as a single impact.

Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed wind turbines

Nature: Impacts on individuals of threatened animal species It has been evaluated that there is one protected frog species that is likely to occur on site, the Giant Bullfrog, and no other species of conservation concern. Likely breeding sites are the edges of small farm dams in watercourses on site. They may forage in surrounding vegetation. On condition habitat in watercourses is not affected to a significant degree, it is unlikely that construction of the wind energy facility will have a significant impact on this species, even if it occurs on site.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-Term (2)	Short-Term (2)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Highly Improbable (1)
Significance	**Low (15)**	**Low (5)**
Status (positive or negative)	Negative	Negative

Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Avoid impacts on wetlands and watercourses, especially small dams and pans in which bullfrogs could potentially breed.

» No personnel on site may cause harm to any individual Giant Bullfrog, at risk of contravening legislation that protects this species.

Cumulative impacts:

Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires) may exacerbate this impact.

Residual Impacts:

Unlikely to be residual impacts.

Nature: Impacts on threatened plant species

There is one near threatened plant species that has been evaluated as having a high probability of occurring on site, the Karoo cycad. A picture of this is shown below. This species is most likely to occur in the thicket vegetation in the southern part of the site. There are a number of turbines that are proposed to be positioned in this area.

Figure 6.3 A Karoo Cycad

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (3)
Probability	Improbable (2)	Highly Improbable (1)
Significance	**Low (22)**	**Low (11)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	

Mitigation:

» If any cycads are found by personnel on site, the position must be reported to the conservation authorities and steps taken to avoid damaging any plants.

» If damage to plants is unavoidable, then a reputable organisation must be contacted to remove the plants to safety and record relevant information about the plant and the habitat in which it was found. A permit will be required for removal of the plant.

Cumulative impacts:

Loss of habitat, soil erosion, alien invasions may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None likely.

Nature: Impacts on indigenous natural vegetation

The collective impact of up to 350 turbines is likely to lead to a loss of up to ~14 ha of natural vegetation. It has been established that the vegetation types on site are classified as Least Threatened, although the site occurs within a Centre of Endemism and has been identified in the Eastern Cape Biodiversity Conservation Plan as being within a corridor area. Components of the site have therefore been classified as having high conservation value on this basis.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low Medium (3)	Low Medium (3)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (55)**	**Moderate (55)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	

Mitigation:

» Avoid unnecessary impacts on natural vegetation surrounding turbine position. Impacts should be contained, as much as possible, within the footprint of the turbine and the surrounding laydown area.

Cumulative impacts:

Soil erosion, alien invasions and damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.

Residual Impacts:

Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

Nature: Impacts on Watercourses

There are a small number of wetlands, drainage lines and watercourses on site that could potentially be affected by the proposed construction of wind turbines. Six of the turbines are currently positioned within mapped watercourse areas.

	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Medium (4)	Medium low (3)
Probability	Definite (5)	Improbable (2)
Significance	**Moderate (55)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Control stormwater and runoff water.
» Obtain a permit from DWA to impact on any wetland or water resource OR move turbines slightly that are currently located within or close to watercourses (turbine numbers unknown).

Cumulative impacts:

Soil erosion, alien invasions, and increased frequency of veld fires may all lead to additional impacts on wetland habitats that will exacerbate this impact.

Residual Impacts:

Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

Nature: Change in runoff and drainage

Hard surfaces created as part of the development, for example, the cement slab at the footprint of each wind turbine, may lead to increased runoff rather than infiltration of water into the ground. Where the ground is relatively flat, this is unlikely to pose too many problems, but on sloping ground, this may lead to increased erosion and siltation of downslope areas. There are both steep slopes and watercourses occurring on site, but turbine positions vary in terms of slope and substrate properties.

A comprehensive stormwater management plan must be compiled, prior to construction, which details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces. Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimise the risk of creating erosion channels. If any erosion features develop, they should be stabilised using

typical measures, such as gabions, weirs, rock-packing, etc.

	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Long-term (4)	Short-term (3)
Magnitude	Moderate (4)	Moderate to low (3)
Probability	Definite (5)	Improbable (2)
Significance	**Moderate (50)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Compile a comprehensive stormwater management plan
» Rehabilitate any disturbed areas immediately to stabilise landscapes
» Water velocity must be reduced and diffused before water is returned to natural systems
» Erosion features must be immediately stabilised, if they develop.
» The position of some of the turbines on very steep slopes must be re-considered and these turbines moved to more appropriate positions.

Cumulative impacts:

Alien invasions, damage to wetlands, loss of habitat and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

Despite proposed mitigation measures, it is expected that this impact will still occur to some degree

Nature: Establishment and spread of declared weeds and alien invader plants

The site is not known to harbour alien trees in significant numbers. There is therefore a weak potential for alien trees to spread or become established following disturbance on site. The presence of a diffuse disturbance over a wide area could, however, lead to the spread of species that are present in the area.

	Without mitigation	**With mitigation**
Extent	Sight & Surroundings (2)	Sight & Surroundings (2)
Duration	Long-Term (4)	Long-Term (4)
Magnitude	Moderate (5)	Moderate To Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (18)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Do not translocate soil stockpiles from areas with alien plants » Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove » Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied.		

Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed substation sites

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	**Low (7)**	**Low (7)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	None required	
Mitigation: » No personnel on site may cause harm to any individual Giant Bullfrog, at risk of contravening legislation that protects this species.		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires) may exacerbate this impact.		
Residual Impacts: Unlikely.		

Nature: Impacts on threatened plant species There is one near threatened plant species that has been evaluated as having a high probability of occurring on site (Karoo cycad). This species is most likely to occur in the thicket vegetation in the southern part of the site. None of the substations are proposed to be positioned in this area.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Highly Improbable (1)	Highly Improbable (1)
Significance	**Low (9)**	**Low (9)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	

Mitigation:

» If any cycads are found by personnel on site, the position must be reported to the conservation authorities and steps taken to avoid damaging any plants.

» If damage to plants is unavoidable, then a reputable organisation must be contacted to remove the plants to safety and record relevant information about the plant and the habitat in which it was found. A permit will be required for removal of the plant.

Cumulative impacts:

Loss of habitat, soil erosion, alien invasions may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None likely.

Nature: Impacts on indigenous natural vegetation

The collective impact of the substations is likely to lead to a loss of a minimum amount of natural vegetation. None of the substations are within sensitive areas.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Medium (4)	Low Medium (3)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (50)**	**Moderate (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Avoid unnecessary impacts on natural vegetation surrounding turbine position. Impacts should be contained, as much as possible, within the footprint of the substation.

Cumulative impacts:

Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

Nature: Impacts on watercourses There are a small number of wetlands, drainage lines and watercourses on site that could potentially be affected by the proposed construction of substations, but none of the substations are currently located within mapped watercourse areas. No impact will therefore occur and the significance of this potential impact is scored as zero for this infrastructure.

Nature: Change in runoff and drainage patterns

Substations are not located on or immediately adjacent to steep slopes or within watercourses.

	Without mitigation	**With mitigation**
Extent	Local And Surroundings (2)	Local And Surroundings (2)
Duration	Long-Term (4)	Short-Term (3)
Magnitude	Moderate (4)	Moderate To Low (3)
Probability	Improbable (2)	Highly Improbable (1)
Significance	**Low (20)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Compile a comprehensive stormwater management plan for the substation footprint and workshop areas
» Rehabilitate any disturbed areas immediately to stabilise landscapes
» Water velocity must be reduced and diffused before water is returned to natural systems
» Erosion features must be immediately stabilised, if they develop.

Cumulative impacts:

Alien invasions, damage to wetlands, loss of habitat and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Sight & Surroundings (2)	Sight & Surroundings (2)
Duration	Long-Term (4)	Long-Term (4)

Magnitude	Moderate (5)	Moderate To Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Do not translocate soil stockpiles from areas with alien plants » Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove » Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed overhead power lines

Nature: Impacts on individuals of threatened animal species It is unlikely that construction of the overhead power lines will have a significant impact on any of threatened animal species.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-Term (2)	Short-Term (2)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Highly Improbable (1)
Significance	**Low (15)**	**Low (5)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » Avoid impacts on wetlands and watercourses, especially small dams and pans in which		

bullfrogs could potentially breed.

» No personnel on site may cause harm to any individual Giant Bullfrog, at risk of contravening legislation that protects this species.

» Power line towers must not be positioned within watercourses, pans or wetlands.

Cumulative impacts:

Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires) may exacerbate this impact.

Residual Impacts:

Unlikely.

Nature: Impacts on threatened plant species		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Highly Improbable (1)
Significance	**Low (20)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» If any cycads are found by personnel on site, the position must be reported to the conservation authorities and steps taken to avoid damaging any plants.

» If damage to plants is unavoidable, then a reputable organisation must be contacted to remove the plants to safety and record relevant information about the plant and the habitat in which it was found. A permit will be required for removal of the plant.

Cumulative impacts:

Loss of habitat, soil erosion, alien invasions may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None.

Nature: Impacts on indigenous natural vegetation

The power line servitude will be approximately 20-30 m wide, but each tower will require a relatively small area to be cleared. There will therefore be localised impacts associated with the construction of each tower. The collective impact of the power lines is likely to lead to a loss of a small amount of natural vegetation. The power lines will not, however, be positioned within sensitive areas of vegetation.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-Term (3)	Medium-Term (3)
Magnitude	Low (3)	Low (3)

Probability	Definite (5)	Definite (5)
Significance	**Moderate (35)**	**Moderate (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Avoid unnecessary impacts on natural vegetation surrounding pylon position. Impacts should be contained, as much as possible, within the footprint of the pylon position.

Cumulative impacts:

Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that will exacerbate this impact.

Residual Impacts:

Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

Nature: Impacts on watercourses

There are a small number of wetlands, drainage lines and watercourses on site that could potentially be affected by the proposed construction of the power lines. There are nine major crossings of watercourses along the power line routes.

	Without mitigation	**With mitigation**
Extent	Local And Surroundings (2)	Local And Surroundings (2)
Duration	Medium-Term (3)	Medium-Term (3)
Magnitude	Low (3)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Control stormwater and runoff water

» Obtain a permit from DWA to impact on any wetland or water resource OR move towers slightly that are currently located within or close to watercourses (if there are towers positioned within these areas).

Cumulative impacts:

Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that will exacerbate this impact.

Residual Impacts:

Despite proposed mitigation measures, it is expected that this impact will still occur to

some degree.

Nature: Change in runoff and drainage patterns		
	Without mitigation	**With mitigation**
Extent	Local and Surroundings (2)	Local and Surroundings (2)
Duration	Long-term (4)	Short-term (3)
Magnitude	Moderate (4)	Moderate to Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Compile a comprehensive storm-water management plan » Rehabilitate any disturbed areas immediately to stabilise landscapes » Water velocity must be reduced and diffused before water is returned to natural systems » Erosion features must be immediately stabilised, if they develop.		
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree		

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Sight & surroundings (2)	Sight & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Moderate to low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible		

» Do not translocate soil stockpiles from areas with alien plants » Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove » Establish an ongoing monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Will probably be very low if control measures are effectively applied

Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed underground power line cables between turbines / internal access roads

Nature: Impacts on individuals of threatened animal species

On the basis of the proposed position of turbines and the fact that turbines will be linearly linked by underground cables, it is almost certain that a number of drainage lines and a significant amount of foraging habitat will be directly impacted upon by the proposed infrastructure.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Medium (5)	Medium (5)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	None required	

Mitigation:

» Avoid impacts on wetlands and watercourses, especially small dams and pans in which bullfrogs could potentially breed.
» No personnel on site may cause harm to any individual Giant Bullfrog, at risk of contravening legislation that protects this species.

Cumulative impacts:

Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires) may exacerbate this impact.

Residual Impacts:

Unlikely.

Nature: Impacts on threatened plant species

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (3)
Probability	Improbable (2)	Highly improbable (1)
Significance	**Low (22)**	**Low (11)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» If any cycads are found by personnel on site, the position must be reported to the conservation authorities and steps taken to avoid damaging any plants.

» If damage to plants is unavoidable, then a reputable organisation must be contacted to remove the plants to safety and record relevant information about the plant and the habitat in which it was found. A permit will be required for removal of the plant.

Cumulative impacts:

Loss of habitat, soil erosion, alien invasions may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

None.

Nature: Impacts on indigenous natural vegetation

Significant areas of vegetation will be cleared for the underground cables and internal access roads between turbines. There will therefore be localised impacts that affect areas throughout the site.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Medium (5)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Moderate (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Avoid unnecessary impacts on natural vegetation surrounding infrastructure positions. Impacts should be contained, as much as possible, within the planned footprint of the infrastructure.

» Do not put infrastructure into the southern parts of the site classified as sensitive.
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

Nature: Impacts on watercourses

On the basis of the current position of turbines and the assumption that internal access roads and underground cables will link these directly, it is almost certain that a high number of small and larger wetlands and watercourses on site will be affected by the construction of infrastructure.

	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Permanent (5)	Long-term (4)
Magnitude	Medium (6)	Medium (4)
Probability	Definite (5)	Probable (3)
Significance	**High (65)**	**Moderate (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Control stormwater and runoff water
» Obtain a permit from DWA to impact on any wetland or water resource OR move turbines slightly that are currently located within or close to watercourses (turbine numbers unknown).
» For any new construction, cross watercourses perpendicularly to minimise disturbance footprints
» Rehabilitate any disturbed areas as quickly as possible

Cumulative impacts:

Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that will exacerbate this impact.

Residual Impacts:

Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

Nature: Establishment and spread of declared weeds and alien invader plants

	Without mitigation	**With mitigation**
Extent	Sight & surroundings (2)	Sight & surroundings (2)
Duration	Long-term (4)	Long-term (4)

Magnitude	Moderate (5)	Moderate to low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Do not translocate soil stockpiles from areas with alien plants » Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove » Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands and increased frequency of veld fires may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

Implications for Project Implementation

Overall the proposed wind energy facility is likely to have a moderate local and regional negative impact on the ecology on site, prior to mitigation. This could be reduced to moderate – low negative after mitigation.

The following recommendations are made to reduce impacts or provide additional information that can lead to reduction or control of impacts:

Planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and underground cable alignments should coincide as much as possible.

6.2.2. Conclusions and Recommendations

A risk assessment was undertaken which identified eight potential negative impacts on the ecological receiving environment. The identified potential impacts are the following:

1. Impacts on bats
2. Impacts on threatened animals
3. Impacts on threatened plants
4. Impacts on protected tree species
5. Impacts on indigenous natural vegetation
6. Impacts on watercourses / wetlands
7. Change in runoff and drainage patterns
8. Establishment and spread of declared weeds and alien invader plants

No threatened bat species are known to occur in the study area and the field survey established that no protected tree species are likely to occur on site. These two potential impacts were therefore not evaluated further. Impacts were assessed separately for wind turbines, substation, internal access roads and powerlines. A summary of impacts, as evaluated, is provided in the table below (Table 6.1).

The wind turbines, internal substations and overhead power lines are unlikely to have impacts of high significance on any ecological features. This is primarily due to the fact that they occupy a relatively small space in the landscape. There are also no flying mammals of high conservation concern that are likely to be affected in the study area.

Internal road infrastructure and underground cables between turbines could potentially have a significant impact on natural vegetation, and watercourses / wetlands. Nevertheless, impacts can be contained to some degree to within the construction area, which reduces potential impacts. One of the most important measures for reducing impacts by all infrastructure is to re-position some turbines and associated infrastructure away from sensitive features.

Infrastructure construction could potentially have any impact on watercourses in the study area, due to the fact that a small number of the turbines are currently situated within designated watercourse areas. Internal access roads to turbines and underground cables between turbines are, however, likely to affect a significant number of watercourses. Potential impacts will have to be carefully controlled to avoid degradation of downstream areas of these watercourses.

Disturbance due to construction of any infrastructure could lead to the spread of alien plants, but this impact can be effectively controlled with suggested measures.

Table 6.1. Summary of ecological impacts

Impact	Wind turbines		Internal substations		Overhead powerline		Underground cables & internal access roads	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
threatened bats	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)
threatened animals	low (15)	low (5)	low (7)	low (7)	low (15)	low (5)	low (27)	low (18)
threatened plants	low (22)	low (11)	low (9)	low (9)	low (20)	low (10)	low (22)	low (11)
protected trees	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)
terrestrial vegetation	medium (55)	medium (55)	medium (50)	medium (45)	medium (35)	medium (35)	high (65)	medium (45)
watercourses	medium (55)	low (20)	zero (0)	zero (0)	low (24)	low (16)	high (65)	medium (30)
runoff/ drainage	medium (50)	low (16)	low 20)	low (8)	medium (30)	low (16)	high (65)	low (16)
alien plants	medium (33)	low (18)	medium (33)	low (18)	medium (33)	low (18)	medium (33)	low (18)

6.3. Assessment of Potential Impacts on Avifauna

The identified impacts of the proposed facility on avifauna include:

» *Disturbance*
Construction, and to a lesser extent on-going maintenance, will create disturbance to birds in the proposed site and surrounding area

» *Habitat destruction*
A certain amount of natural vegetation will be destroyed during the construction of the facility. Although the actual final footprint of the facility is likely to be relatively small, heavy machinery needed during construction is anticipated to need large turning circles and hence destroy a larger area of vegetation than the final footprint.

» *Collision with turbines*
This is potentially the most significant impact of the proposed development, and could negatively affect a variety of collision prone species.

» *Electrocution on power infrastructure and collision with power lines*
Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components

On the basis of these on-site observations, and in combination with the available SABAP atlas data for the general area, 12 priority species are recognised as key

in the assessment of avian impacts of the proposed Amakhala Emoyeni Wind Energy Facility, and as suitable surrogates for impacts on other species. These are mostly nationally and/or globally threatened species which are known to occur, or could occur in relatively high numbers in the development area and which are likely to be, or could be, negatively affected by the wind energy project.

The birds of greatest potential relevance and importance in terms of the possible impacts of the proposed wind energy facility are likely to be:

» Erratic incursions and/or seasonal influxes of non-breeding Cape Vulture, drawn down from higher lying areas to the north-east to feed on stock losses. It seems likely that the birds which visit the Cookhouse area are from an established roost at "Agieskloof", some 10 km to the north-east. This is believed to be mainly a summer roost, used by up to 120 birds in the off-season, and much depleted in the winter (from Feb-March to Sept-Oct) when most of these birds move east to breed. Cape Vultures may be attracted to the development area by the combination of (i) open, grassy slopes with good slope soaring conditions, (ii) small stock farming with heavy losses associated with drought and/or lambing and carcasses left where they fall, and (iii) convenient lines of power line pylons to provide safe perch/roost sites.
» Flocks or breeding pairs of Blue Crane, Denham's Bustard and White-bellied Korhaan, and possibly seasonal influxes of Ludwig's Bustard. These are all Red-listed, collision prone and possibly displacement prone species.
» A range of locally resident or visiting raptors foraging in or moving through the area. These are all collision and possibly displacement prone species.
» A suite of restricted range endemic passerines possibly susceptible to loss of habitat and/or displacement from the area by the development of the wind energy facility.

Impacts of the proposed wind energy facility are most likely to be manifest in the following ways:

» Mortality of Cape Vultures foraging in the area, using ridge lines targeted by the development for turbine placements as sources of slope lift, and colliding with the turbine blades or any new power lines associated with the facility.

» Disturbance and displacement of resident/breeding large terrestrial birds (Denham's and Ludwig's Bustards, Blue Crane and White-bellied Korhaan) from nesting and/or foraging areas by construction and/or operation of the facility, and / or mortality of these species in collisions with the turbine blades or associated new power lines while commuting between resource areas (croplands, nest sites, roost sites/wetlands).

» Displacement of resident/visiting raptors (especially Black Harrier, Martial Eagle, Secretarybird, Lesser Kestrel and Lanner Falcon) from foraging areas by construction and/or operation of the facility, and / or mortality of these species in collisions with the turbine blades or associated new power lines while slope-soaring along the high-lying ridges or hunting in the valleys, or by electrocution when perched on power infrastructure.

» Disturbance and displacement of resident/breeding Grassland endemics (especially Melodious Lark), by construction and/or operation of the facility.

The following series of tables provides a summary of the potential impacts on avifauna associated with the construction and operation of the proposed wind energy facility.

Impact tables summarising the significance of wind energy facility impacts on avifauna (with and without mitigation)

Nature: Disturbance during construction Noise, movement and temporary occupation of habitat during the building process. Likely to impact all birds in the area to some extent, but sensitive, sedentary and/or habitat specific species will most adversely affected.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short (1)	Short (1)
Magnitude	High (9)	Medium (7)
Probability	Definite (5)	Definite (5)
Significance	**60 (Moderate-High)**	**50 (Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Possible	Probably not
Can impacts be mitigated?	Yes	
Mitigation: » Abbreviating construction times as far as possible » Scheduling activities around avian breeding and/or movement schedules (specifics to be determined by pre-construction monitoring) » Lowering levels of associated noise » Reducing the size of the inclusive development footprint. » More detail is contained in the EMP (Appendix O).		
Cumulative Impacts: Considerable if, as seems likely, other wind energy developments could be under construction nearby at the same time.		
Residual Impacts:		

Some priority species may move away regardless of mitigation.

Nature: Habitat loss during construction		
Destruction of habitat for priority species, either temporary – resulting construction activities peripheral to the built area, or permanent - the area occupied by the completed development.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Medium-high (7)	Low-medium (5)
Probability	Definite (5)	Definite (5)
Significance	**70 (High)**	**60 (Moderate-high)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Possible	Probably not
Can impacts be mitigated?	Yes	
Mitigation: » Minimising habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible. » Building as few temporary roads as possible and reducing the final extent of developed area to a minimum.		
Cumulative Impacts: More wind energy developments in the area will increase habitat losses exponentially.		
Residual Impacts: Some species may be permanently lost to the area regardless of mitigation.		

Nature: Disturbance during operation		
Noise and movement generated by operating turbines and maintenance activities is sufficient to disturb priority species, causing displacement from the area, adjustments to commute routes with energetic costs, or otherwise affecting nesting success or foraging efficiency.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Lifetime of the facility (4)	Lifetime of the facility (4)
Magnitude	Moderate (8)	Moderate (7)
Probability	Highly probable (4)	Highly probable (4)
Significance	**56 (Moderate)**	**52 (Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Possible	Possible

Can impacts be mitigated?	Slightly	

Mitigation:

» Abbreviating maintenance times as far as possible
» Scheduling activities in relation to avian breeding and/or movement schedules
» Lowering levels of associated noise

Cumulative Impacts:

Considerable. At least two more wind energy facilities are proposed for the same general area, substantially raising disturbance levels, and extending the displacement or barrier effect across a broader front.

Residual Impacts:

Some priority species may be permanently lost from the area.

Nature: Mortality

Collision of priority species with the wind turbine blades and/or any new power lines, or electrocution of the same on new power infrastructure.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Lifetime of the facility (4)	Lifetime of the facility (4)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**60 (Moderate)**	**30 (Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Possible
Can impacts be mitigated?	Yes	

Mitigation:

» Careful siting of turbines
» Marking power lines
» Use of bird friendly power hardware
» Monitoring priority bird movements and collisions. Turbine management sensitive to these data – radar assisted if necessary

Cumulative Impacts:

Considerable if more wind energy facilities developed in the same area.

Residual Impacts:

Some priority species may be permanently lost from the area.

Implications for Project Implementation

The facility may have a detrimental impact on these birds, particularly during its operational phase, unless significant commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to tolerable

and sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South Africa avifauna.

Mitigation of potential impacts will be best achieved in the following ways:

» Minimise the disturbance impacts associated with the construction of the facility, by abbreviating construction time, scheduling activities around avian breeding and/or movement schedules (actual timing to be refined by the results of pre-construction monitoring), and lowering levels of associated noise.
» Minimise habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible, building as few temporary roads as possible, and reducing the final extent of developed area to a minimum.
» Minimise the disturbance impacts associated with the operation of the facility, by abbreviating maintenance times, scheduling activities in relation to avian breeding and/or movement schedules (actual timing to be refined by the results of pre-construction monitoring), and lowering levels of associated noise.
» A decision on if and where to delineate exclusion zones on these peaks and ridges to minimise collision risk for slope soaring birds cannot be made at this stage, in the absence of adequate information on how often, when, under what conditions, and expressly where Cape Vultures and other affected species use these ridges for cross-country flying. This information will require additional observations to be done at the site (e.g. see pre-construction monitoring below).
» Ensuring that all dead stock are removed from the land as soon as possible (and perhaps relocated to safe 'restaurant' area for vultures at least 20 km from the site, and that all landowners within a wide radius (>10 km) of the facility are asked to do the same. This should reduce the numbers of vultures attracted to the area and lower the risk of collision.
» Ensure that lighting on the turbines is kept to a minimum, and is coloured (red or green) and intermittent, rather than permanent and white, to reduce confusion effects for nocturnal migrants.
» Minimise the length of any new power lines installed, ensuring that all new lines are marked with bird flight diverters from origin to destination, and that all new power infrastructure is adequately insulated and bird friendly in configuration. Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line. The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets

the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.

» Carefully monitoring the local avifauna pre- and post-construction (see below), and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded for any of the priority species listed in this report.
» Ensure that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potentially considerable cumulative effects on the local/regional avifauna of multiple wind energy projects proposed for this area.
» Additional mitigation might include re-scheduling construction or maintenance activities on site, shutting down problem turbines either permanently or at certain times of year or in certain conditions, or installing a 'DeTect' or similar radar tracking system to monitor bird movements and institute temporary shut-downs as and when required (as determined by bird monitoring programme). The latter is an expensive option, but may be requisite if the interface between vultures and turbines is deemed to be too frequent and too direct to avoid significant numbers of vulture fatalities. The size of the proposed facility may compromise the efficacy of this system, but intelligent application in identified, critical areas may be essential.

6.3.1. Conclusions and Recommendations

This is a medium-large wind energy project, proposed for a site with few significant conflicting issues in terms of its avifauna. Although the development area does not impinge significantly on any known major bird fly-ways or unique landscape features, it will potentially affect populations of regionally or nationally threatened (and impact susceptible) bird species likely to occur within or close to the proposed turbine arrays.

The proposed facility is likely to have a moderate, long-term impact on the avifauna of the area, and may negatively affect key rare, red-listed and/or endemic species. The most important negative impacts are likely to be on Cape Vulture, Denham's Bustard and Blue Crane. These birds (and other priority species) may be disturbed by construction of the facility, lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (bustards and cranes), or may suffer mortalities in collisions with the turbine blades and power lines (vultures, other raptors, bustards and cranes). Such

effects can probably be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme, mainly involving careful and responsible development and management of the facility, with sensitivity to potential, negative impacts and a preparedness to adjust operating procedures in a sincere effort to mitigate such impacts. The impacts of this development must also be viewed in the context of the potentially substantial, cumulative effects generated by multiple wind energy projects proposed for the immediate vicinity.

A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined (refer to Appendix O), from pre-construction and into the operational phase of the project.

6.4. Assessment of Potential Impacts on Geology and Soils

The geological impact assessment aims to assess the impact that the proposed development will have on the geological environment which includes the parent rock and the natural soil profile.

The proposed activity will include excavation or displacement of soil, stockpiling, mixing, wetting and compaction of soil and pollution and these activities carry potential negative direct impacts contributing to soil degradation. These activities could also cause negative indirect impacts such as increased siltation in other areas away from the site causing negative impact on water sources and agriculture with socio-economic repercussions. The severity or significance of the various impacts is related to the nature and extent of the activity. There are no known positive impacts relating to the geological environment and the impacts are dominantly related to the construction phase with very little additional impacts in the post construction and decommissioning phases.

The most important geological issues are the direct impacts of soil degradation and erosion of topsoil from the area of activity. This would affect the ecosystems operating in the topsoil and the plant and animal species that depend on it for growth and survival. Other direct impacts would include the loss of agricultural potential of the area. The significance of these impacts obviously depends on the present quality of the topsoil and the agricultural potential of the area. The proposed positioning of turbines generally falls within areas of low-moderate sensitivity in terms of soil erosion.

Indirect impacts could include increased siltation in nearby streams and dams caused by an increase in erosion from the site and socio-economic impacts resulting from the loss of topsoil and lower agricultural potential.

Main impacts with regards to the geological environment include:

» **Soil degradation**

Soil degradation is the removal, alteration or damage to soil and soil forming processes, usually due to human activity. The stripping of vegetation or disturbance to the natural ground level over disturbance areas will negatively impact on soil formation, natural weathering processes, moisture levels, soil stability, humus levels and biological activity. Soil degradation includes erosion (due to water and wind), salinisation, acidification, water-logging, pollution, soil mining and burial, compaction and crusting

Soil erosion is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and/or physical transport on the land surface. Soil erosion induced or increased by human activity is termed "accelerated erosion" and is an integral element of global soil degradation. Accelerated soil erosion is generally considered the most important geological impact in any development due to its potential impact on a local and regional scale (i.e. on and off site) and as a potential threat to agricultural production and self sufficiency.

The proposed development layout indicates that turbines are concentrated on upland areas of low relief. This is primarily to maximise wind energy but also to reduce construction access difficulty and improve stability of turbine foundations. These areas also tend to be less sensitive in terms of erodibility potential as the hydraulic energy is generally low and the unconsolidated transported soils are generally thinner. In summary, slopes steeper than 1:4 and areas associated with natural drainage lines (especially at the foot of steep slopes) should be avoided if possible.

» **Degradation of parent rock**

Apart from the impact on the overlying soil, excavations into bedrock may result in unsightly scars, resulting in potential visual impacts. More importantly, deep or poorly planned excavations may potentially affect the stability of the surroundings, such as rock slides along road cuttings. It is a common misconception that excavations into bedrock do not affect ecosystems. Excavations into bedrock may affect the geohydrology of an area and can even contaminate groundwater. Blasting operations associated with excavations into rock have obvious environmental issues, chiefly including noise pollution, dust, vibrations and chemical hazards.

The proposed activity in areas of high relief may have significant impact in this regard as the access roads may involve deep cut-and-fill operations. This will depend on the layout of access roads and the transportation requirements.

Impact tables summarising the significance of impacts on geology associated with the wind energy facility

Nature: Soil degradation – Removal or burial of topsoil (cut-and-fill) in disturbance areas (areas where construction activity takes place around proposed structures or along access roads) impacting on soil forming processes and resources.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Medium term (3)
Magnitude	High (8)	Moderate (6)
Probability	Definite (4)	Definite (4)
Significance	**Moderate (52)**	**Moderate (40)**
Status	Negative	N/A
Reversibility	Irreversible	N/A
Irreplaceable loss of resources?	Yes, moderate	Minor
Can impacts be mitigated?	To a certain extent	
Mitigation: » Minimise disturbance areas. » Rehabilitate soil and vegetation after construction.		
Cumulative impacts: Potential removal of soil/rock from foundations is 350 turbines x 600 m^3=210 000 m^3). This excludes earthworks for assembly platforms. This is the second wind energy facility in the area and there are possibly others planned in the future. The cumulative impact of topsoil removal and burial is considered moderate even with mitigation.		
Residual impacts: N/A		

Nature: Soil degradation – Pollution, salinisation, acidification or water-logging of natural soil in construction areas affecting soil formation processes.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Minor	Minor
Can impacts be mitigated?	Yes	
Mitigation:		

» Minimise disturbance areas. » Rehabilitate soil and vegetation. » Use spoil from excavations for landscaping or run off site – don't dump in piles. » Stage earthworks in phases across site so that exposed areas are minimised. » Keep to existing roads, where practical, to minimise impacts on undisturbed ground.
Cumulative impacts: Cumulative impact of soil pollution from all development in the area is considered low if mitigating measures are applied diligently.
Residual impacts: Minor negative – slow regeneration of vegetation & soil, localised erosion

Nature: Soil degradation – Mixing, stockpiling and compaction of topsoil affecting soil formation processes.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (32)**	**Low (24)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Minor	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Prevent unnecessary excavations and stockpiling. » Restrict height of stockpiles to reduce compaction. » Restrict number of access roads and minimise traffic. » Rehabilitate soil and vegetation in areas of activity. » Keep to existing roads, where practical, to minimise impact on undisturbed ground. » Stage earthworks in phases to minimise exposed ground.		
Cumulative impacts: The cumulative impact of soil mixing, etc from all development in the area is considered low if mitigating measures are adopted.		
Residual Impacts: Minor negative – slow regeneration of soil processes in and under topsoil		

Nature: Soil erosion – Increased sheet, rill or gulley erosion and deposition down-slope due to the removal of vegetation and other activity in construction areas.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Short term (1)
Magnitude	Moderate (6)	Low (4)

Probability	Highly probable (4)	Probable (3)
Significance	**Moderate (40)**	**Low (18)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Moderate	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Restrict zone of disturbance. » Implement effective erosion control measures. » Stage construction in phases to minimise exposed ground. » Keep to existing roads, where practical, to minimise impact on undisturbed ground. » Ensure stable slopes of stockpiles/excavations to minimise slumping		
Cumulative impacts: The cumulative impact of soil erosion from all development in the area is considered low if mitigating measures are adhered to.		
Residual Impacts: Minor – Localised movement of sediment. Slow regeneration of soil processes		

Nature: Degradation of parent rock – Excavations causing degradation to local geology and instability.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, minor	Yes, minor
Can impacts be mitigated?	To a degree	
Mitigation: » Restrict zone of disturbance and plan excavations carefully. » Plan any new access roads taking contour lines into consideration to minimise cutting and filling operations. » Keep to existing roads, where practical, to minimise impacts on undisturbed ground.		
Cumulative impacts: The cumulative impact of rock degradation from all development in the area is considered low if mitigating measures are applied diligently.		
Residual Impacts: Minor.		

Nature: Soil degradation - deposition down-slope affecting soil forming processes and siltation of waterways and dams (indirect impact)		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Moderate (48)**	**Low (30)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Moderate – depends on planning	Minor
Can impacts be mitigated?	To a degree	
Mitigation: » Install anti-erosion measures such as silt fences in disturbance areas.		
Cumulative impacts: The cumulative impact of siltation from all development in the area is considered low if mitigating measures are applied diligently.		
Residual Impacts: Minor localised movement of soil across site		

Implications for Project Implementation

A basic assessment of the potential geotechnical constraints on the project indicates no insurmountable problems or "fatal flaws" which have may have an impact on the design and construction processes. The overall impact of all the proposed activity on the geological environment is considered moderate without mitigating measures. With effective implementation of mitigating measures the impacts identified above can be reduced to a low level.

6.4.1. Conclusions and Recommendations

The proposed development will have a low to moderate impact on the geological environment and these impacts can be largely mitigated with a resultant low overall significance due to the scattered nature of the proposed activity and the limited extent of the proposed earthworks. The anticipated geology also appears to be generally favourable in terms of erodibility potential. The proposed layout of turbines has been designed to avoid areas of the site with unfavourable topography and this bodes well for erosion. The proposed layout is deemed acceptable in terms of this impact study.

6.5. Assessment of Potential Impacts on Heritage Sites and Palaeontology

Pre-colonial archaeology from the Holocene and Pleistocene periods exists in the area and could be impacted by the proposed activity. The majority of these sites are of low significance but a smaller number would require mitigation if they were to be disturbed by proposed activities.

Historical features, buildings and graveyards associated with farms are present within the study area. Preliminary historical research has indicated that farms in the area were granted in the early 19th century to Dutch speaking farmers and buildings of this period are present on the site. A number of structures are clearly older than 60 years and are therefore protected by the National Heritage Resources Act (Act No 25 of 1999). No physical impacts to the occupied farm settlements are anticipated, but abandoned settlements and their associated features could be damaged in a number of ways. These impacts can be mitigated through avoidance and management. Although owners have consented to the proposed development, they will experience changes to the cultural and visual landscape as a result of the activities at both construction and operational phases.

Possible impacts to cultural landscape due to visual impacts of the proposed project are a concern and are addressed in a separate specialist Visual Impact Assessment (refer to section 6.6 below).

In terms of fossil potential, the site is underlain by sediments of the lower Beaufort Group, Karoo Supergroup. The succession of sediments increases in age from c. 260Ma in the south to 255Ma in the north. These sediments were laid down by ancient river systems that were flowing from south toward the north and preserve a variety of fossil organisms of this time from therapsids (mammal-like reptiles), amphibians, fishes, freshwater invertebrates (mainly bivalves) and plants. The predominantly terrestrial sediments of the Beaufort Group have, throughout South Africa, yielded a large number of vertebrate fossils in the form of amphibians, early primitive reptiles (the captorhinids), mammal like reptiles (therapsids), and fish. Minor freshwater invertebrates (molluscs) and plant fossils have also been recovered. For the most part however, the fossils found in the Beaufort sediments are considered to be rare, particularly in the lowermost part of the succession.

Impact table summarising the significance of impacts on heritage sites and palaeontology (with and without mitigation)

Nature: Disturbance to possible on surface and sub-surface pre-colonial archaeology
The main cause of impacts to archaeological (and palaeontological) sites is physical disturbance of the material and its context. The heritage and scientific potential of an

archaeological site is highly dependent on its geographic 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 unless careful note is made of the circumstances of the find and associated information. Large scale excavations therefore may damage archaeological sites, similarly, construction of roads and laydown areas and injudicious use of off-road vehicles can also contribute to high levels of impact. The power lines themselves have less of an impact as their footprint is smaller, although installation activities can be problematic. The frequency of impact increases when more people are introduced to an area (e.g. construction teams).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate < 30**	**Low < 24**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

Mitigation measures:

» Inspect road alignments. Mitigation is proposed in the form of avoidance. If avoidance is not possible then some sampling and/or excavation may be required.

Cumulative impacts:

Low

Residual impacts:

Yes. Damage will have occurred which is irreversible and lasting into the future.

Nature: Disturbance to historic buildings, ruins and other structures, excluding graveyards

Direct impacts on the distinctive historic structures are not expected but inevitably some will occur. Long term use of the site will introduce many people to the site and as a result, the possibility for theft of fittings and materials from heritage buildings increases.

Turbines and other infrastructure should avoid identified significant sites. Tree lines or stands of trees are often associated with settlements or farming related features. They are an integral part of the cultural landscape, and every effort should be made to avoid having to remove any. Depending on the way that historic structures are utilised during the construction and operational phases, both negative and positive impacts could result.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly probable (4)	Improbable (2)

Significance	**Moderate < 48**	**Low < 18**
Status (positive or negative)	Negative	Neutral to positive
Reversibility	No	No
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

Mitigation measures:

» Road alignments & substation sites to be inspected before construction.
» Built environment features and other cultural landscape indicators to be avoided where possible.

Cumulative impacts:

Low

Residual impacts:

Mitigation measures should control impact. Some positive results if certain buildings are adaptively re-used during construction and operation phases. Buildings with heritage content are a distinct target for theft of fittings. Vandalism can result as a secondary impact from such activities.

Nature: Disturbance to cemeteries and graves

Buffer zones around cemeteries and graveyards will need to be implemented to ensure that they are not damaged during the construction of access roads or other infrastructure. A significant negative impact will result from the disturbance of graves.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (8)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	**Moderate > 42**	**Low > 19**
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

Mitigation measures:

» Road alignments, substations to be inspected.
» Mitigation should take the form of implementing no-go buffer zones around all cemeteries and graves. If unmarked burials are discovered during construction, a plan of action must be in place to deal with the situation.

Cumulative impacts:

Low

Residual impacts:

Irreversible damage and negative perceptions will occur if a grave is disturbed.

Nature: Potential impacts on cultural landscape

Massed wind turbines, are without doubt conspicuous 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 cumulative effect this could have on future tourism potential (although initially the wind energy facilities may create some tourism opportunities). There are times of the year when tourism into the Bedford area increases but generally it is not what one could define as a major tourist centre. This means that the potential for alteration to the cultural landscape and sense of place is considered an issue but is probably moderate. Other wind energy facilities are planned in the area, which could add to the cumulative effects of the interventions and will definitely detract from the rural character.

	Without mitigation	**With mitigation**
Extent	Local (4) (possible regional implications)	Local (4) (possible regional implications)
Duration	Long term (5)	Long term (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High >60**	**High >60**
Status (positive or negative)	Negative	Negative - possibly neutral
Reversibility	Yes (lifespan of facility)	Yes
Irreplaceable loss of resources?	Possibly	
Can impacts be mitigated?	No	

Mitigation measures:

» No mitigation possible. The presence of turbines and other infrastructure will have a negative impact regardless of localised mitigation.

Cumulative impacts:

The cumulative impacts may be significant as further wind energy facilities are planned for adjoining properties.

Residual impacts:

Scarring of the landscape (particularly due to the access road network) can never be fully rehabilitated.

Nature: Disturbance or destruction of valuable fossil heritage within the potentially fossiliferous lower Beaufort Group sediments

	Without mitigation	**With mitigation**
Extent	International (5)	International (5)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Very high (10)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Moderate (40)**	**Low (20)**
Status (positive or	Negative	Negative

negative)		
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes – but to a limited extent	
Mitigation: » Should substantial fossils be exposed during construction, the ECO should safeguard these - in situ. SAHRA and / or a professional palaeontologist should then be alerted as soon as possible so that appropriate mitigation measures can be implemented.		
Cumulative impacts: Any construction activities have the potential to impact on the valuable fossil heritage.		
Residual Impacts: N/A		

Implications for Project Implementation

The area is of an overall moderate cultural sensitivity, however there are a number of recommendations which must be considered in order to reduce potential impacts on heritage resources from a moderate to a more acceptable moderate-low significance. There is also the potential for impacts on fossil resources, this impact is potentially of moderate significance but can be reduced to low significance with the implementation of mitigation and monitoring measures.

It is recommended that the following mitigation measures are implemented:

Archaeological heritage

» Existing farm tracks must be re-used or upgraded as far as possible to minimise the amount of change to un-transformed landscape
» During the detailed planning phase, drawings of proposed road alignments, infrastructure and near-final turbine positions should be submitted to an archaeologist for review and field-proofing. Micro-adjustment of alignments and turbine positions is likely to be sufficient to achieve adequate mitigation
» A "walkdown" of final cable routes, power lines and access roads will be required to be conducted by a certified professional archaeologist / heritage consultant
» If farm buildings are to be re-used, the refuse middens should be protected
» It is illegal at all times to destroy or change and archaeological site without a permit.

Built environment

» Conserve old buildings, kraals, dams and wall alignments – do not demolish or damage
» Do not demolish wind pumps. Some of these are protected structures

» Follow a policy of non intervention – particularly with respect to old farm buildings
» Theft of fittings from historic buildings (particularly abandoned ones) needs to be monitored and culprits fined and charged under NHRA
» Seek guidance from a heritage consultant if any buildings are to be restored for use during either construction or operational phases
» Keep infrastructure at least 1 km away from farm complexes
» Apply to the relevant provincial/national heritage authorities to demolish or alter historic structures (buildings, walls, kraals etc over 60 years).

Cultural landscape

» Turbines must be positioned in such a way that they are at least 500m away from farm complexes, all of which have heritage elements;
» Turbines must be positioned in such a way that shadow flicker does not affect any farm complexes;
» Road alignments must be planned in such a way that the minimum of cut and fill operations are required and erosion measures are in place;
» Guarantees for demolition of turbines after their useful life must be in place as a condition of approval.

Fossil material

» Should substantial fossils (such as vertebrate remains of any sort or plant-rich beds) be exposed at any time during construction, the environmental control officer on site should safeguard these, *in situ*, where feasible. SAHRA and/or a professional palaeontologist should then be alerted as soon as possible so that appropriate mitigation measures can be implemented.

6.5.1. Conclusions and Recommendations

No fatal flaws have been identified in terms of potential heritage and palaeontology impacts. There are a number of mitigation measures which will need to be considered during the construction, operation and decommissioning of the facility.

» Archaeological heritage
The ephemeral ESA and MSA stone tool scatters recorded during this survey are of low significance and mitigation will not be necessary in most cases. LSA sites tend to be in valleys and would not generally be impacted by turbines. The provisional plan provided for the location of the turbines and substations therefore indicates that they are likely to be in areas where there is little to no archaeological issues. However, no diagrams have been provided indicating the access roads as these will only be finalised once the positions of infrastructure is fixed after the consideration of the comments of

the specialists in the EIA. It is presumed that use will be made of existing roads, where some may have to be widened to accommodate large trucks and cranes, and new roads will need to be constructed to access turbines in isolated portions of the study area. A professional heritage consultant will need to examine the proposed routes before construction commences, but major mitigation is not anticipated as being required for this type of material apart from some realignments and avoidance of sensitive areas. Micro-adjustment of turbine footings, moderate deviations in service trenches, road alignments or power lines are expected to be all that will be required in terms of mitigation of open pre-colonial/colonial sites. If for any reason mitigation by avoidance is not feasible, the usual process is to record and sample the archaeological site before its destruction is permitted.

» Unidentified archaeological material, graves, fossils and fossil bone
There is always a chance that archaeological material may be exposed during bulk excavation for services and foundations and service roads where there was no evidence of such on the surface (unmarked graves are a case in point). All archaeological material over 100 years of age is protected by the NHRA and may only be altered or removed from its place of origin under a permit issued by SAHRA. In the event of anything unusual being encountered, the SAHRA archaeology unit must be consulted immediately so that mitigation action can be determined and be implemented if necessary (find-stop scenario). Mitigation is at the cost of the developer. Diversion of machinery/plant may be necessary until mitigation in the form of conservation or archaeological/palaeontological sampling is completed.

» Built Environment
Based on the provisional information supplied for the survey, it is not expected that any stone structures such as the ruins of old buildings, kraals, etc will be directly impacted by the proposal. It is not expected that the built environment will be directly impacted by the proposal unless it becomes necessary to demolish structures that are greater than 60 years of age. It is possible that use of some farm houses may change as a result of the activity (domestic to commercial), in which case application of the requirements of the NHRA is appropriate to any alterations, the responsibility for which falls on the landowner. Theft of fittings and building material could be an issue at the construction and operational phase. This will largely be mitigated by management procedures, and audits. It is anticipated that in most, if not all instances, it will be possible to adjust turbine locations to avoid impacts. Road alignments must be inspected prior to construction.

» Cemeteries and graves

None of the identified cemeteries and graves will be directly impacted by the placement of the turbines or substations. Some graveyards are located close to farm roads. There is a very real possibility that they may be impacted during the construction phase if the farm road is used. A series of GPS waypoints defines polygons around graves and cemeteries. These should be considered no-go areas. While graves tend to be associated with settlements, and usually on silt terraces, they are unlikely to be impacted by turbine positions. Unmarked graves can however occur in unpredictable locations.

» Cultural landscape and sense of place
This is perhaps the most difficult heritage impact to address. There is no doubt that the wind turbines will affect the prevailing landscape qualities of the site and the degree of that impact will be very closely related to the visual impacts of the proposed activity (the visual impact will be separately addressed as a specialist report). Locating of infrastructure close to historical farms and settlements may result in impacts to the quality of the place and detract from sense of history and/or wilderness. From this perspective the layout of the facility will need to respond to the findings of the heritage impact component of the EIA in conjunction with input from the visual specialist.

» Fossil material
Should substantial fossils (such as vertebrate remains of any sort or plant-rich beds) be exposed at any time during construction, the environmental control officer on site should safeguard these, *in situ*, where feasible. SAHRA and/or a professional palaeontologist should then be alerted as soon as possible so that appropriate mitigation measures can be implemented.

6.6. Assessment of Potential Visual Impacts

The visibility or visual exposure of any structure or activity forms the basis of the visual impact assessment. It stands to reason that if the proposed infrastructure, or evidence thereof, weren't visible, no impact would occur.

Viewshed analyses of the proposed wind turbines, substations and overhead power lines were modelled, based on a 20m contour interval digital terrain model of the study area, indicate the potential visual exposure. The visibility analyses were undertaken from each of the proposed wind turbine positions (350 in total) at an offset of 100 m above average ground level. The viewshed analyses do not include the visual absorption capacity of the vegetation for the study area, as the natural vegetation cover, predominantly mountain grassland and shrubland is not expected to influence the results of the analyses significantly.

The visibility map (Figure 6.5) clearly illustrates the influence of the topography and the placement of the wind turbines on ridges within the facility footprint, on the potential frequency of exposure. The highest frequency of exposure is expected towards the north, north-east, to the east and to some extent the far south of the proposed facility. The Winterberge north of the site act as an effective visual shield to areas further to the north.

It is evident from the viewshed analyses that the proposed wind energy facility would have a large area of visual exposure on the plateau due to the tall wind turbine structures. The distinct north, west and south-facing escarpments of the plateau interrupt the medium distance visual exposure to the north, west and south, although longer distance sighting would still be possible, especially from higher lying areas to the west and south.

The facility would be exposed to only scattered areas to the east due to the undulating, mountainous nature of the terrain. The facility would be visible from the south facing slopes of these mountains and from the Baviaans River valley and Daggaboersnek mountain pass. The facility will potentially be visible from most of the N10 stretch south of Cookhouse, as well as the R350 south of Bedford. The latter road will be exposed to a high frequency of exposure for the most part. Only limited sections of the R63 and the R344 will be visually exposed to the facility, and the frequency of exposure in these sections will be high. Secondary roads in close proximity of the proposed development site will also be exposed. The proposed facility would be visible with a high frequency of exposure from the outlying areas south of Bedford, as well as from, outlying areas west of Cookhouse, but with a lower frequency of exposure. It is not expected to be visible from Adelaide, as this town is located north-east of a series of ridges that shield it from the facility. Smaller homesteads, farms and settlements identified within the study area (some situated within close proximity of the proposed development site) may also be impacted on. Lastly, the proposed facility will be highly visible from the Doorn Boom Game Farm and to a lesser extent, from the East Cape Game Farm and the Woodlands Game Reserve. Visibility frequency will generally be high from high lying sections within the Doorn Boom Game Farm, while visibility frequency impacting on the latter two game farms will be lower.

It is envisaged that the structures would be easily and comfortably visible, especially within a 5km radius of the wind energy facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

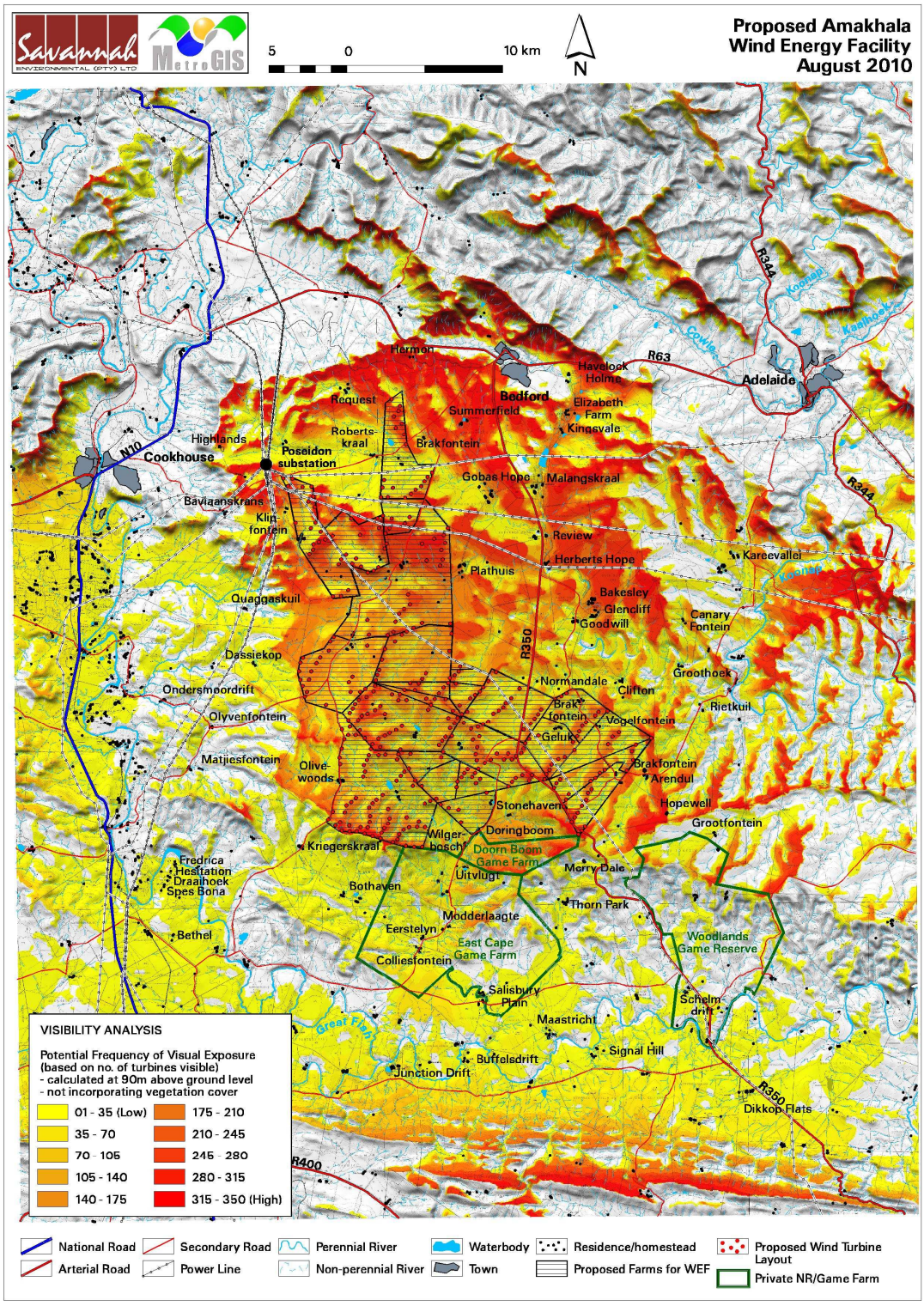


Figure 6.5 Potential visual exposure of the proposed Amakhala Emoyeni Wind Energy Facility

Although viewer incidence is relatively low within a 5 km radius of the proposed facility, the region has a high scenic value, and attracts a certain amount of tourism as a result. Residents and visitors to this area are therefore seen as

sensitive visual receptors upon which the construction of the facility could have a negative visual impact.

Within a 10km radius, viewer incidence increases with the presence of larger towns such as Cookhouse and Bedford. These towns are significant in their locations along national and arterial roads – these are used by tourists and as a result the towns have tourism value and potential.

The rest of the study area consists predominantly of grazing land, game farming land or vacant natural land with a low to insignificant occurrence of observers. These observers are however classified as sensitive visual due to their inherent negative visual perception of the proposed wind energy facility.

The severity of the visual impact on the above receptors decreases with increased distance from the proposed facility.

» **Visual Impact Index**

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed wind energy facility, and the associated infrastructure are displayed on Figure 6.6 below. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index. An area with short distance, high frequency visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map clearly indicates the core area of potentially high visual impact within a 5km radius of the proposed facility. Potential areas of very high visual impact include the R350 arterial road and all the secondary roads.

Within a 10km radius, visually exposed homesteads and settlements (sensitive visual receptors) represent sites of potentially very high visual impact.

Sections of the R350 arterial road and some secondary roads to the east of the site also have a very high visual impact rating due to the high frequency of observations of the project infrastructure by observers travelling along this road.

Farm settlements that can expect to be visually influenced (i.e. experience a potentially high or very high visual impact) by the proposed facility, within a 10km radius of the development are indicated in the table 1 of the Visual Impact Assessment (Appendix I).

National and arterial roads that may fall within areas of potentially low visual impact include a section of the N10 south of Cookhouse, where partial views of the facility are expected, a small section of the R63 (between Bedford and Adelaide) and the section of R350 beyond the 5km radius from the proposed wind energy facility. All secondary roads south of the R63 and beyond the 10km radius are expected to be exposed to moderate visual impact. Roads traversing mountainous terrain (e.g. the Daggaboersnek mountain pass) within the region may afford observers a clear, yet long distance (beyond 10km), view of the proposed development and may constitute low to very low visual impact.

Indications are that the development would not be visible from the town of Adelaide and that observers only on the outskirts of Cookhouse may have partial views of the wind energy facility from distances exceeding 10km, constituting a low potential visual impact. Similarly, the town of Bedford itself would not experience visual impact, but observers on the outskirts of the town may have medium distance views of the facility which will constitute a high visual impact. It should be noted, however, that visual clutter on the outskirts of urban areas usually acts as a visual filter, implying that this visual impact may not necessarily be perceived as high, but will be moderated somewhat.

Lastly, in terms of the protected areas in close proximity to the wind energy facility, the entire Doorn Boom Game Farm will be exposed to high and very high visual impact, as will the northern parts of the Eastern Cape Game Farm and a small section of the Woodlands Game Reserve.

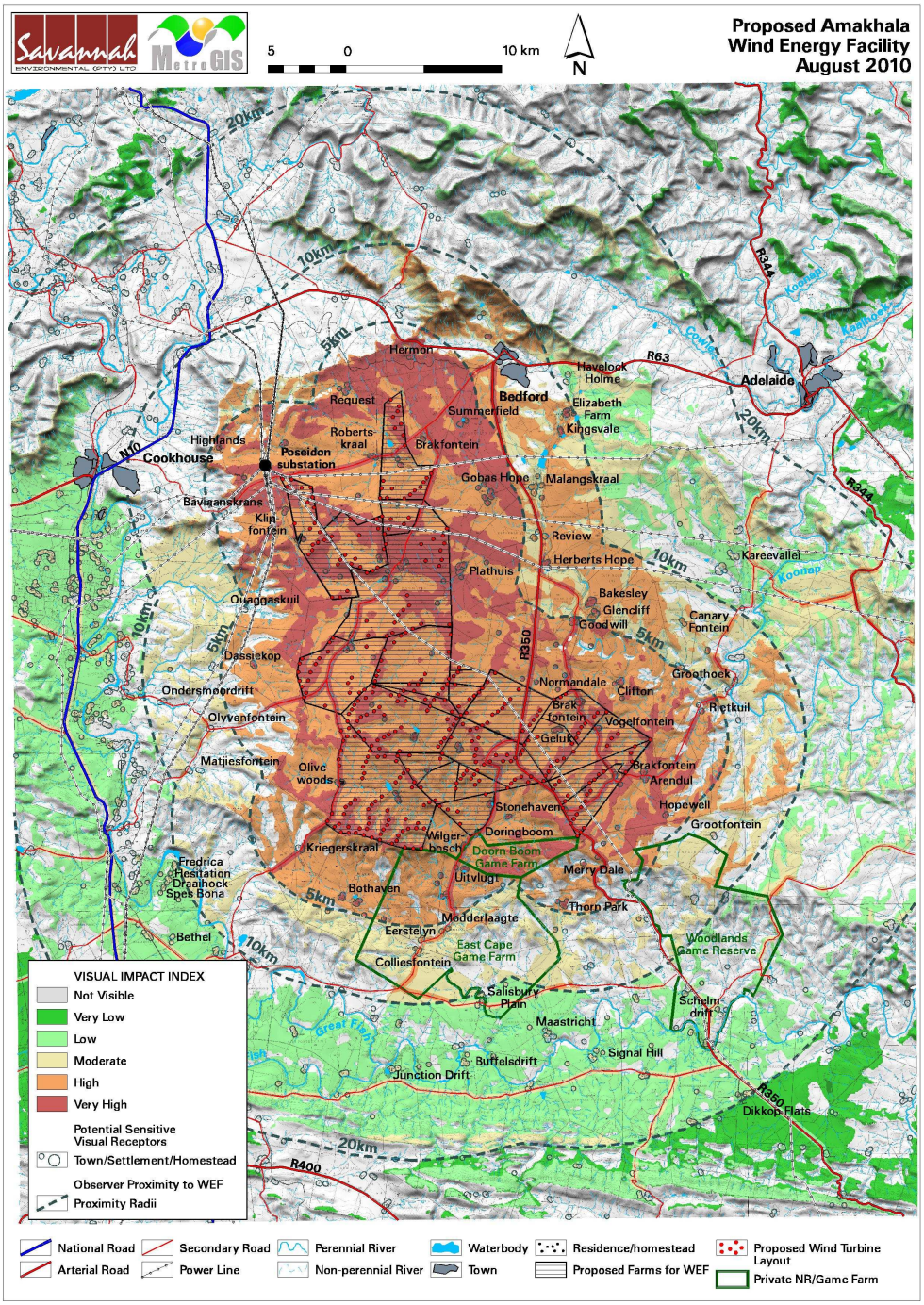


Figure 6.6: Visual impact index of the proposed Amakhala Emoyeni Wind Energy Facility

» **Ancillary Infrastructure**

There are to be two 33/132kV substations and one 33/132/220/400 kV substation located within the development footprint. These will in turn be linked each other and to existing infrastructure by 132kV overhead powerlines. The viewshed of both the substations and powerlines are in fact absorbed by the larger viewshed of the turbines.

The substations and associated powerlines are not expected to create a major negative visual disturbance, as this smaller scale infrastructure will be dominated by the much taller wind turbines and thus blend in with the facility. Some localised visual impacts may occur, but are not expected to be significant in comparison to the construction of the wind turbines.

Some degree of cumulative impact is expected as much of the infrastructure including turbines, substations and powerlines will add to impacts caused by infrastructure related to the Cookhouse Wind Energy Facility, adjacent to the site.

Within the development footprint, access roads will be required, firstly to construct each turbine (construction phase), and secondly to maintain the turbines (operational phase). A network of roads will thus be constructed within the site footprint giving access to the turbines and other infrastructure. This network of roads has the potential of manifesting as a network of significant landscape scarring, and a potentially significant visual impact within the viewshed areas. If the road network is laid out indiscriminately, not taking cognisance of the topography, then both the roads themselves, and the graded slopes would be vulnerable to erosion over time. The effects of erosion also represent a potential visual impact to observers.

» **Lighting**

The areas selected for the placement of the 3 substations is within the development footprint, so too is the proposed route for the powerline infrastructure. The surrounding area has a relatively small number of populated places (settlements and farmsteads). Although these are not densely populated areas, the light trespass and glare from the security and after-hours operational lighting (flood lights) for the substations will have some significance. Furthermore, the sense of place and cultural ambiance of the local area increases its sensitivity to such lighting intrusions.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance.

The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. The wind energy facility is not required to have a light fitted to each turbine, but it is compulsory to have synchronous flashing lights on the turbines representing the outer perimeter of the facility. In this manner, less warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

The regulations for the CAA's Marking of Obstacles should be strictly adhered too, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow in an otherwise dark environment.

» **The potential to mitigate visual impacts**

The primary visual impact, namely the appearance of the Wind Energy Facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

The analysis of the potential visual exposure of the proposed turbine layout reveals the fact that the placement of the turbines on top of prominent topographical features tends to increase the frequency of exposure. The careful placement of the wind turbines in relation to the topography (in cases where the turbine layout has not yet been finalised) does however offer some opportunity for mitigation. However this may have an influence on the potential efficiency of the facility if wind conditions are different (i.e. of wind speeds are slower).

Removal or relocation of turbines from high lying areas is not feasible as the whole site shares similar characteristics. Relocation of turbines will only result in shifting impacts to another receptor within the area. There is thus no mitigation to ameliorate the negative visual impacts anticipated for the turbine sites.

Impact tables summarising the significance of visual impacts associated with the wind energy facility

Nature of Impact: Potential visual impact on users of arterial and secondary roads in close proximity of the wind energy facility. Visual impacts on arterial and secondary roads are expected to be very high within a 5km radius of the proposed development. Anticipated visual impacts on these roads between 5km and 10km of the proposed development are expected to be very high and high.		
	No mitigation	Mitigation considered
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)

Magnitude	Very high (5)	Very high (5)
Probability	High (4)	High (4)
Significance	**High (64)**	**High (64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	No	
Mitigation: » Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other possible mitigation.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse Wind Energy Facility (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None.		

Nature of Impact: Potential visual impact on residents of homesteads/settlements in close proximity to the proposed facility. The visual impact on the towns of Adelaide, Bedford and Cookhouse is expected to be low to negligible and is not reflected in the table below. The potential visual impact on residents of homesteads within a 5km radius of the proposed facility is expected to be high and very high, while the visual impact on residents between the 5km and 10km radii will be high.		
	No mitigation	**Mitigation considered**
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Very High (5)	Very high (5)
Probability	High probability (4)	High (4)
Significance	**High (64)**	**High (64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	
Can impacts be	No	

mitigated during operational phase?	

Mitigation:

» Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other mitigation possible.

Cumulative impacts:

The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse WEF (200 wind turbines) will increase the cumulative visual impact within the region.

The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).

Residual impacts:

Not applicable

Nature of Impact: Potential visual impact on scenic natural features, on tourist destinations and on tourists travelling through the area.

The potential visual impact on tourist destinations and tourist routes is expected to be very high within a 10km radius of the facility.

Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (5)	High (5)
Probability	High (4)	High (4)
Significance	**High (64)**	**High (64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	No	

Mitigation:

» Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility.

Cumulative impacts:

The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse Wind Energy Facility (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).

Residual impacts:

None.

Nature of Impact: Potential visual impact on private nature reserves and conservancies in close proximity to the proposed facility Visual impact on the Game Farms and Game Reserves (Doorn Boom, Eastern Cape and Woodlands) will be high within 10km of the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (5)	Very high (5)
Probability	High (4)	High (4)
Significance	**High (64)**	**High (64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	No	
Mitigation: » Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other mitigation possible.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse Wind Energy Facility (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None.		

» **Photo Simulations**

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the facility within the receiving environment. It indicates the visual significance of the alteration of the landscape from various sensitive visual receptors and over varying distances. The simulations are based on the wind turbine dimensions and layout as indicated in Figure 6.1.

The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility. The photograph positions are indicated on the map below and should be referenced with the photo simulation being viewed in order to place the observer in spatial

context. The approximate viewing distances indicated were measured from the closest wind turbine(s) to the vantage point.

The simulated views show the placement of the wind turbines during the longer-term operational phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken. It is imperative that the natural vegetation be restored to its original status for these simulated views to ultimately be realistic. These photographs can therefore be seen as an ideal operational scenario (from a visual impact point of view) that should be aspired to.

Figure 6.7: Viewpoint from the R350 ~20 km south of Bedford. This position is indicative of what will be seen from close quarters while driving south towards the facility. The viewing direction is south-westerly and roughly 122 turbines may be fully to partially visible in the landscape.

Figure 6.8: View from the R350 as it enters the site from the south. This position is very close to the closest turbines and is indicative of what will be seen from the western sections within the facility footprint. This view includes the cumulative view combining both proposed Amakhala Emoyeni Wind Energy Facility and approved Cookhouse Wind Energy Facility turbine positions.

Implications for Project Implementation

This anticipated visual impact is not considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region and the relatively contained area of potential visual exposure. Furthermore, it is the opinion of the author that this impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres. In addition, most of the roads act as tourist access routes rather than scenic drives. It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures proposed above and in the Environmental Management Plan (Appendix O). There are not many recommendations as to the mitigation of the visual impact of the core facility, as there is no opportunity to place the wind turbines on lower ground, and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

There remains a land use conflict with regard to the private nature reserves, as there is no opportunity to mitigate the negative effects of the wind energy facility. As a result, there could potentially be some limitation on tourism opportunities in the future.

It is recommended that open and direct discussions be held with the owners of the Doornboom, East Cape and Woodlands Game Farms regarding the potential future limitations on tourism opportunities as a result of the expected visual impact of the facility.

It is also recommended that the ancillary infrastructure (distribution lines, substations, access roads, etc.) be appropriately planned with due cognisance of the topography, that all disturbed areas be properly rehabilitated, and that all infrastructure and the general surrounds are maintained in a neat and appealing way.

The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.

Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.

Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. Mitigation of secondary visual impacts associated with the construction of roads include careful planning of the access road network, taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse steep slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

Also, the construction areas, including road servitudes and cut and fill slopes must be appropriately rehabilitated after construction. This rehabilitation must also be monitored and maintained in order to minimise the visual impact of the access roads.

As the power line must follow the most direct route, and the alignment must be protected from fire by means of cutting back vegetation within the servitude, there is no mitigation for this visual impact.

Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

- » Reduce the construction period through careful planning and productive implementation of resources.
- » Restrict the activities and movement of construction workers and vehicles to the immediate construction site.
- » Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
- » Restrict construction activities to daylight hours (if possible) in order to negate or reduce the visual impacts associated with lighting.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an ongoing basis.

6.6.1. Conclusions and Recommendations

The construction and operation of the Amakhala Emoyeni Wind Energy Facility and its associated infrastructure, adjacent to the Cookhouse Wind Energy Facility (Environmental Authorisation issued by DEA) will have a visual impact on the natural scenic resources and rural character of this region.

Wind energy facilities have an advantage over other more conventional power generating plants (e.g. coal-fired power stations) as a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers. The facility further has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants. The advantage being that the facility can become an attraction or a landmark within the region that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

However, this opinion should not distract from the fact that the facility would be visible for a large area that is generally seen as having a special landscape and tourism value. The facility would thus visually impact on various sensitive visual receptors that should ideally not be exposed to industrial style structures. The potential visual impact on users of major and secondary roads in close proximity

to the proposed facility, as well as on residents of nearby towns and settlements, will be of high significance. The significance of the potential visual impact on protected areas in close proximity to the facility (0 – 5 km) will also be high as will the potential visual impact on tourist access routes and destinations.

Furthermore, this area acts as a gateway for many tourists en-route to coastal holiday destinations as well as National Parks such as the Addo Elephant National Park.

Due to the Cookhouse Wind Energy Facility being authorised in the same area, there exists a possibility that both facilities may ultimately be built. In this respect, one must consider the combined cumulative impacts of both the Cookhouse and Amakhala Emoyeni facilities on the receiving environment. This could be seen as an ameliorating factor, as the potential visual impacts for both facilities will be localised within a constrained and defined geographical area. Also, the visual impact of the new facility will be absorbed to some extent by the existing visual impact of the existing facility.

This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the relatively contained area of potential visual exposure.

6.7. Assessment of Potential Noise Impacts

Potential receptors within 2 km of the edge of the proposed wind energy facility were identified and the status of the dwelling confirmed by a site visit.

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103. SANS 10103 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. Ambient (background) noise levels were measured during the day and night time in accordance with the South African National Standard SANS 10103:2003. From the data obtained, it can be seen that the ambient (background) sound levels are extremely low, ranging between 17 – 23 dBA during times when there is no wind, or very little air movement. As wind speeds increase, noise created by potential wind turbine generators approaches the wind induced noise levels.

Increased noise levels are directly linked with the various activities associated with the construction of the facility and related infrastructure, as well as the operational phase of the activity.

» **Potential Noise Sources: Construction Phase:**

- *Construction activities include*
  - construction of access roads,
  - establishment of turbine tower foundations and electrical substation(s),
  - the possible establishment, operation and removal of concrete batching plants,
  - delivery of turbine, substation and power line components to the site,
  - digging of trenches to accommodate underground power cables; and
  - erecting of turbine towers and assembly of wind turbine generators.

- *Material supply: Concrete batching plants*

- *Blasting*

- *Traffic*

- **Potential Noise Sources: Operational Phase**

Noise emitted by wind turbines can be associated with two types of noise source. 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. These sources normally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations, traffic as well as power line noise.

- *Wind Turbine Noise: Aerodynamic sources*
- *Wind Turbine: Mechanical sources*
- *Transformer noises (Sub-stations)*
- *Power Line Noise (Corona noise)*
- *Low Frequency Noise*

The noise emissions into the environment from the various sources as defined by the project developer were calculated for the construction and operational phase in detail, using the sound propagation model described in SANS 0357.

The following was considered in the Noise Impact Assessment:

» The octave band sound pressure emission levels of processes and equipment;
» The distance of the receiver from the noise sources;
» The impact of atmospheric absorption;
» The meteorological conditions in terms Pasquill stability;

- The operational details of the proposed project, such as the location of each wind turbine.
- Topographical layout,
- Acoustical characteristics of the ground. Soft ground conditions were modelled, as the area where the facility is to be constructed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

In addition, the noise emission into the environment from the various traffic options will be calculated using the sound propagation model described in SANS 10210.

- **Construction Phase Impacts**

  For the purpose of the EIA the activities that are most likely to create the most noise are:

  - General work at the 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 various building sand will be taken directly to the construction area (foundation establishment). Activities are taking place for 16 hours during the 16 hour day-time period.
  - Phase 1: 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). Activities are taking place for 8 hours during the 16 hour day-time period.
  - Phase 2: Preparation of foundation area (sub-surface removal until secure base is reached – excavator, compaction, general noise). Activities are taking place for 10 hours during the 16 hour day-time period.
  - Phase 3: 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.
  - Phase 4: Erecting of the wind turbine generator (general noise, electric generator/compressor and a crane). Activities are taking place for 16 hours during the 16 hour day-time 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 less than 40 km/h, with a maximum of 5 trucks and 5 vehicles per hour to be modelled travelling to the areas where work is taking place.

For noise modelling it was assumed all equipment would be operating under full load (generate the most noise) and with the construction activities selected/positioned to be close to a sensitive receptor.

» **Operational phase impacts**

Day-time period (working day) was not considered for the EIA because noise created during the day by the facility is normally masked by other noises from a variety of sources surrounding potential sensitive receptors.

Typical daytime activities would include:

- The operation of the various wind turbines,
- Maintenance activities (relative insignificant noise source).

However, times when a quiet environment is desired (at night for sleeping, weekends etc.) noise levels are more critical. The time period investigated therefore would be the quiet period, normally associated with the 22:00 – 06:00 slot. Maintenance activities would therefore not be considered, concentrating on the ambient sound levels created due to the operation of the various wind turbines at night.

From the modelling it can be seen that a number of receptors could be impacted during times when a quiet environment is desirable (Refer to Noise specialist EIA study – Appendix L).

Impact tables summarising the significance of noise impacts (with and without mitigation) during Construction

Nature: Noise associated with numerous simultaneous construction activities Acceptable Rating Level: rural district with little road traffic: 45 dBA outside during day.		
	Without mitigation	**With mitigation**
Extent	Regional – impact will extend more than 1,000 meters from activity (3)	Regional – impact will extend more than 1,000 meters from activity (3)
Duration	Long term – noisy activities in the vicinity of the receptor could last up to a month (4)	Long term – noisy activities in the vicinity of the receptor could last up to a month (4)
Magnitude	Estimated noise level up to 52 dBA High (8)	Critically depends on the equipment selected as well as which mitigation measures are implemented. However, making use of grader instead of a bulldozer for site preparation and allowing only one noisy activity to take place close to a potential receptor would reduce the noise

		levels at PSRs, in so reducing the change in ambient sound levels the PSRs may detect. A good relationship with the closest receptors will also minimise any potential for annoyance, as it reduces the probability that people will get annoyed. Due to the temporary nature of the construction of access roads and trenches the consideration of the mitigation measures as proposed would be sufficient. Medium (6)
Probability	Due to the size of the area, as well as the distances between the WTG's and the Sensitive Receptors, the noise impact due to construction should be low. This is because the total projected noise levels at the receptors, as well as the change in ambient sound levels they may experience is low. In addition, this impact is mainly during the day when the potential sensitive receptors are either away or busy with their normal daily activities. Noises created by their normal daily activities would mask most construction related noises. This will minimizes the possibility that this additional noise would impact on their quality of living. Likely (3)	Improbable (1)
Significance	**Moderate (45)**	**Low (13)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of	N/A	N/A

resources?		
Can impacts be mitigated?	Yes.	
Mitigation: While it has been identified that mitigation is not critical, the following mitigation is still highlighted: » Reducing the number simultaneous activities when working close to a receptor. » Ensuring that all equipment and machinery are well maintained and equipped with silencers (where possible). » Considering the noise emission characteristics of equipment when selecting equipment for a project/operation. » Working together with the local communities, and prior warning when a noisy activity is to take place. » Only conduct very noisy activities between 10am and 4pm. » Co-ordinate noisy activities (when working closer than 500 meters) with PSRs to allow work to take place in periods when they are not at home, or busy with daily activities, e.g. limiting noisy work between 8 am and 2 pm. » Conduct noisy activities in the shortest possible time (site preparation with bulldozer and civil work using an excavator) » Move the closest turbines further from the receptors, or do not construct any turbines within 500 meters from potential receptors. This will move the construction sites. The increased distanced from the activities and the receptors could have the single most significant reduction in noise levels		
Cumulative impacts: This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area.		
Residual impacts: This impact will only disappear once construction activities cease.		

Impact tables summarising the significance of noise impacts (with and without mitigation) during Operation

Nature: Noise associated with numerous simultaneous operation activities Acceptable Rating Level: rural district with little road traffic: 35 dBA outside during day.		
	Without mitigation	**With mitigation**
Extent	Local – impact will extend less than 1,000 meters from activity (2)	Local – impact will extend less than 1,000 meters from activity (2)
Duration	Permanent – facility will operate for a number of years (5)	Permanent – facility will operate for a number of years (5)
Magnitude	Estimated noise level high as 40.8 dBA Medium (6)	By modelling the proposed mitigation, where problematic turbines were relocated further than 1,000 meters from potential sensitive receptors

		Medium (6)
Probability	Likely (3)	Improbable (1)
Significance	**Moderate (39)**	**Low (13)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	N/A	N/A
Can impacts be mitigated?	Yes	

Mitigation:

» It is recommended that wind turbines that could have a potential direct impact be moved to a location further than 1,000 meters from receptors. If these turbines are moved to a different area, yet still within 1,000 meters from a receptor, independent noise modelling should be conducted again.

» If a turbine is to be developed within 1,000 meters from a downwind receptor, the developer must highlight the potential noise impact on the receptor(s), as well as the estimated percentage that the wind blows into the direction of the PSR, together with the results of the independent noise modelling.

» The noise emission specifications of wind turbine generators must be considered when selecting the equipment. This could be smaller equipment, more quiet equipment or both. If there are turbines within a 1,000 meter setback distance from PSRs, quieter WTGs is suggested.

» A combination of the options proposed above.

Refer to Noise specialist study (Appendix L) for locations of the abovementioned turbines and sensitive receptors.

Cumulative impacts:

This impact is cumulative with existing ambient background noises.

Residual impacts:

This impact will only disappear once the operation of the wind energy facility stops or sensitive receptors no longer exist.

Distances between PSRs and closest turbines

SR113

Wind turbines 57: 680 m, WTG 51: 800 m, WTG 58: 890 m, WTG 56: 950 m.

SR127

Wind turbine 206: 660 meters. This turbine is also situated on a hill with the receptors in a valley directly south of this turbine.

SR126

All turbines are located approximately 1,000 meters from dwelling. However, this receptor has 12 turbines within 1500 meters from the dwelling, and is situated in a "valley – drainage area" at a lower altitude than the turbines. Cumulative

effects increase the probability that he might be impacted on. Uncertainties increase the probability. Receptor SR126 should clearly understand the potential risks, as no matter where the wind blows from, this receptor is likely to hear noise from the turbines.

Implications for Project Implementation

The noise impact on surrounding areas (outside of the development footprint) are of low significance. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of moderate significance, but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a low significance. Care must be taken to ensure that the operations at the facility do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors. Consideration of the layout of turbines specifically around SR111, SR112 and SR113 should be considered.

Quarterly monitoring noise monitoring at the potential sensitive receptors is recommended on a quarterly basis, to be conducted by an approved noise inspection authority for the first year of operation. This monitoring is to take place during late afternoon (16:00 – 18:00), late evening (20:00 – 24:00) as well as early in the morning (03:00 – 06:00). At least two of these samples should be during times when the wind energy facility is operational. Quarterly monitoring post construction is recommended at SR113, SR126 and SR127, as well as any other receptors that have complained to the developer regarding noise originating from the facility. Annual feedback regarding noise monitoring should be presented to all stakeholders and other interested and affected parties in the area. Noise monitoring must be continued as long as noise complaints are registered.

The noise EIA study should also be made available to all potential sensitive receptors in the area, or the contents explained to them to ensure that they understand all the potential risks that the development of a wind energy facility may have on them and their families.

6.7.1. Conclusions and Recommendations

Wind turbines produce sound, primarily due to mechanical operations and aerodynamics effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources, and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that does impact areas at some distance away. When potential sensitive receptors are nearby,

care must be taken to ensure that the operations at the facility do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

It should be noted that this does not suggest that the sound from the wind turbines should be inaudible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source – but rather that the sound due to the wind turbines should be at a reasonable level in relation to the ambient sound levels.

The current impact that the proposed wind energy facility could have on several surrounding potential receptors is considered of potentially moderate significance.

Should the layout change significantly, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist. This includes the situation when the existing layout is slightly modified, yet some of the potentially problematic turbines are still within a radius of 1,000 meters from a potentially sensitive receptor.

With the implementation of the proposed mitigation actions the significance of the impact would be reduced to an acceptable low significance.

6.8. Assessment of Potential Social Impacts

Impacts on the social environment as a result of the wind turbines are expected to occur during both the construction and operation phases.

The key social issues associated with the ***construction phase*** include:

» Potential positive impacts
- Creation of employment and business opportunities

» Potential negative impacts
- Impacts associated with the presence of construction workers employed on the project;
- Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site;
- Increased risk of veld fires associated with construction related activities;
- Impact of heavy vehicles, including damage to roads, safety, noise and dust;
- Loss of agricultural land associated with construction related activities.

The key social issues affecting the ***operational phase*** include:

» Potential positive impacts
  - Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training
  - Impact on tourism and the creation of potential tourist opportunities
  - The promotion of clean energy as an alternative energy source and establishment of Cleaner Development Mechanism (CDM) project.

» Potential negative impacts
  - Impact of the proposed wind energy facility on the current farming activities, specifically the potential loss of productive farm land
  - The visual impacts and associated impact on sense of place

The following series of tables provides a summary of the potential social impacts associated with the construction and operation of the proposed wind energy facility.

Impact table summarising the significance of social impacts (with and without mitigation) associated with the construction phase of the wind energy facility

Nature: Creation of employment and business opportunities during the construction phase

Based on the information from other wind energy projects, the total capital expenditure during the construction phase will be in the region of R 15 billion. The construction phase is expected to extend over a period of 24-30 months and create approximately 200-220 employment opportunities. The work associated with the construction phase will be undertaken by contractors and will include the establishment of the access roads and services and the erection of the wind turbines.

It is anticipated that approximately 25% (or 55) of opportunities will be available to skilled personnel (engineers, technicians, management and supervisory), 35% (or 77) to semi-skilled personnel (drivers, equipment operators), and 40% (or 88) to low skilled personnel (construction labourers, security staff etc). Due to the low education and skills levels in the area, the majority of opportunities for residents in the local towns of Cookhouse, Bedford and Somerset East are likely to be limited to the low skilled category. The majority of the employment opportunities are likely to be associated with the contactors appointed to construct the facility and associated infrastructure. In this regard the majority of contractors use their own staff and this will limit the potential for direct employment opportunities for locals during the construction phase.

The proposed development will create an opportunity to provide on-site training and increase skills levels. However, the majority of these opportunities are likely to benefit the workers employed by the contractors and not locals from the area. Due to the low education and skills levels in the area the opportunities for skills development and training of locals are likely to be limited. Mr. Chris Wilken and Rob Beach of the Blue Crane

Development Agency (BCDA) indicated that the proposed facility would attract skilled professionals to the area who could potentially settle and add value to the area in terms of access to expertise etc. This was seen as a positive impact.

In terms of business opportunities for local companies, the expenditure of R 15 billion during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and the high import content associated with wind turbines the opportunities for the local Cookhouse/Bedford/Somerset East economy are likely to be limited. The sector of the local economy that is most likely to benefit from the proposed development is therefore the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. As indicated above, the majority of the construction workers will be accommodated in the towns of Cookhouse, Bedford and Somerset East. This will create opportunities for local hotels, B&Bs, guest farms and people who want to rent out their houses. In addition, a proportion of the total wage bill earned by construction workers over the 24-30 month construction phase will be spent in the regional and local economy. The wage bill associated with the construction phase is estimated at R35 million per annum (current value). The total wage bill for the four-year construction phase will therefore be in the region of R 87.50 million. The injection of income into the area in the form of rental for accommodation and wages will create opportunities for local businesses in towns such as Cookhouse, Bedford and Somerset East. The benefits to the local economy will however be confined to the construction period (24-30 months).

The local hospitality industry in Cookhouse, Bedford and Somerset East is also likely to benefit during the construction phase. These benefits are associated with accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other personnel involved on the project. Experience from other large construction projects indicates that the potential opportunities are not limited to onsite construction workers but also to consultants and product representatives associated with the project (PPC's Dwaalboom Cement Factory, 2007).

	Without enhancement	**With enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local communities)	Local – Regional (4) (Rated as 4 due to potential opportunities for local communities)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Moderate (32)**	**Moderate (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

Enhancement Measures:

Employment

» Where possible, Windlab should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area;
» Before the construction phase commences Windlab should meet with representatives from the Blue Crane Municipality to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase;
» The local authorities, community representatives and organisations on the interested and affected party database should be informed by the Environmental Consultants (Savannah Environmental) of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that Windlab intends following for the construction phase of the project;
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase;
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
»

Business

» Windlab should develop a database of local companies, specifically Historically Disadvantaged (HD) companies, that qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» Where possible, Windlab should assist local HD companies to complete and submit the required tender forms and associated information.
» The Blue Crane Municipality in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry should identify strategies aimed at maximising the potential benefits associated with the project.

Cumulative impacts:

Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities this benefit is likely to be limited.

Residual impacts:

Improved pool of skills and experience in the local area. However, due to relatively small number of local employment opportunities this benefit is likely to be limited.

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers

Based on the findings of the SIA the area can be described as a rural area that is "safe and secure". In terms of affected farmsteads, there are a relatively small number of farmsteads that will be affected. However, there are a number of potentially vulnerable farming activities, specifically sheep and cattle farming. The potential threat to farming activities is discussed below. In addition, the presence of construction workers also poses

a potential risk to family structures and social networks in the area (both on farms and in the local towns of Cookhouse and Bedford). 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 the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour 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).

The potential risk to local family structures and social networks is, however, likely to be low. This finding is based on the relatively small number of construction workers associated with the construction phase, namely 200-220. In addition, the potential impact will be reduced if the majority of low skilled workers are sourced from the local community. These workers will form part of the local family and social network and, as such the potential impact will be low. The use of local residents to fill the low skilled job categories will also reduce the need to house construction workers on the site. T his will reduce the potential impact on vulnerable farm labourers and their families. Initial indications are that the majority of the construction workers will be accommodated in the towns of Cookhouse and Bedford. However, local farmer, Mr. Peter Bowker, indicated that Windlab had informed him workers would be housed on site during the construction phase.

The majority of construction workers that fall within the skilled category and are likely to be housed in the nearby towns of Cookhouse, Bedford and Somerset East where they will be accommodated in local B&B's and houses.

	Without mitigation	**With mitigation**
Extent	Local (2) (Rated as 2 due to potential severity of impact on local communities)	Local (1) (Rated as 1 due to potential severity of impact on local communities)
Duration	Very short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc (5)	Very short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc (5)
Magnitude	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc (10)
Probability	Probable (3)	Probable (3)
Significance	**Low** for the community as a whole **(21)** **Moderate-High** for specific individuals who may be affected by STDs etc **(51)**	**Low** for the community as a whole **(18)** **Moderate-High** for specific individuals who may be affected by STDs etc **(48)**

Status (positive or negative)	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on subsistence farming for their livelihoods	
Can impacts be mitigated?	Yes, to some degree. However, the risk cannot be eliminated.	

Mitigation Measures:

» Where possible, Windlab should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks.

» Windlab should consider the establishment of a Monitoring Forum (MF) for the construction phase. The Forum should be established before the construction phase commences and include key stakeholders, including representatives from the local community, local councillors, farmers and the contractor. The role of the Forum would be to monitor the construction phase and the implementation of the recommended mitigation measures. The monitoring forum should also be briefed on the potential risks to the local community associated with the presence of construction workers.

» Windlab and the contractor should, in consultation with representatives from the MF, develop a code of good conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation.

» Windlab and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase.

» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis.

» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 24-30 month construction phase. This would reduce the risk posed by construction workers to local family structures and social networks.

» It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay overnight on the site. However, should the need arise to house construction workers on the site the total number is likely to be relatively low (less than 100). This will make it possible to manage the potential impacts effectively.

» Refer to EMP (Appendix O) for more detailed mitigation measures.

Cumulative impacts

Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned/unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

Residual impacts
See cumulative impacts.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site
The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may also be damaged. Stock and game losses may also result from gates being left open and/or fences being damaged. Based on comments from some farmers it would appear that Windlab have entered into an agreement with the affected landowners whereby the company will compensate farmers for damages to farm property and disruptions to farming activities. It is assumed that this includes losses associated with stock theft and damage to property etc.

	Without mitigation	**With mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc	Yes, compensation paid for stock losses etc
Irreplaceable loss of resources?	No.	
Can impacts be mitigated?	Yes however some loss of farmland cannot be avoided.	

Mitigation Measures:

» Windlab should establish a Monitoring forum 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 Windlab and the contractors before the contractors move onto site;
» Windlab should hold contractors liable for compensating farmers and communities 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 Windlab, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below);
» The EMP must outline procedures for managing and storing waste on site, specifically

plastic waste that poses a threat to livestock if ingested;

» Contractors appointed by Windlab must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.

» Contractors appointed by Windlab must ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;

» The housing of construction workers on the site should be limited to security personnel. However, should the need arise to house construction workers on the site the relatively low number of construction workers that will need to be housed on site (less than 100) will make it possible to manage the potential impacts effectively.

Cumulative impacts

No, provided losses are compensated for.

Residual impacts

No, provided losses are compensated for.

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires

The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires that in turn pose a threat to the livestock, wildlife and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened.

The potential risk of veld fires is heightened by the windy conditions in the area, specifically during the dry, winter months. All of the farms farm sheep or cattle and, as such, their livelihoods are dependent on grazing on their farms. Any loss of grazing due to a fire would therefore impact negatively on the affected farmers livelihoods. The risk of fire related damage is exacerbated by the distance to fire-fighting vehicles located in the nearest towns of Cookhouse, Bedford and Somerset East.

	Without mitigation	**With mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate-High due to reliance on livestock for maintaining livelihoods (8)	Low-Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for	Yes, compensation paid for

	stock losses etc	stock losses etc
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation Measures:

» Contractor to ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
» Contractor to 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 clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months.
» Contractor to provide adequate fire fighting equipment on-site.
» Contractor to provide fire-fighting training to selected construction staff
» As per the conditions of the Code of Good Conduct, in the advent of a fire being 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 fire fighting costs borne by farmers and local authorities.

Cumulative impacts:

None, provided losses are compensated for.

Residual impacts:

None, provided losses are compensated for.

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site and damage to roads.

Road access to the proposed site is mainly from the R350 (south of Bedford) via a secondary dirt road linking Bedford to Cookhouse via Patryshoogte. The movement of heavy construction vehicles during the construction phase will damage roads and create noise, dust and safety impacts for other road users.

Based on information from other wind energy facilities approximately 5 abnormal heavy load trips are associated with the transport of a single turbine onto site. These include loads associated with 40-55 m rigid turbine blades, as well as abnormally heavy loads associated with the 80-ton nacelles. The total number of trips associated with the proposed facility is therefore in the region of 1 800. In addition, a crawler crane (~ 750 t) and assembly cranes will also need to be transported onto and off the site. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc.

The damage to gravel roads by heavy equipment can result in a number of potential negative impacts, including increased wear on vehicles owned by local farmers, impact on ease of access (e.g. time delays, detours) to stock posts, between neighbors and members of the farming community, as well as access to local towns (services, retail, socialising). While a relatively large number of properties are affected for a significant period of time,

the current road use frequency is low.

The findings of the SIA indicate that the issues related to the movement of heavy vehicle traffic during the construction phase can also be effectively mitigated. These issues are therefore not regarded as significant concerns.

	Without mitigation	**With mitigation**
Extent	Local (3) (Rated as 2 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation Measures:

» The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts: :

If damage to roads is not repaired then this will impact on the farming activities in the area and also result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.

Residual impacts:

Refer to cumulative impacts.

Nature: 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 wind turbines, sub stations and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

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 wind turbines, substations and power lines will damage farmlands and result in a loss of farmlands for future farming activities. This is an issue that has been raised as a concern by the local farmers.

The significance of the impacts is to some extent mitigated by the fact that the farming activities in the area are confined to stock farming as opposed to crops. Windlab have also entered into an agreement with the affected landowners whereby the company will compensate for damages. It is assumed that this includes the loss of productive farmland. In addition, the experience with wind energy facility developments elsewhere is that livestock farming is not significantly affected by the facility. The final footprint of disturbance associated with the facility is also small and is linked to the foundation of the individual wind turbines, services roads, substations and power lines. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not rehabilitated (5)	Short term if damaged areas are rehabilitated (1)
Magnitude	Moderate, due to importance of farming in terms of local livelihoods (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (60)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No, in case of footprint associated with the facility	No, in case of footprint associated with the facility
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impacts be mitigated?	Yes, however, loss of farmland cannot be avoided	

Mitigation Measures:

» The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop etc) should be minimised;
» An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
» All areas disturbed by construction related activities, such as access roads, construction platforms, workshop area etc, should be rehabilitated at the end of the construction phase;
» The implementation of a rehabilitation programme within the EMP should be included in the terms of reference for the contractor/s appointed to establish the facility.
» The implementation of the Rehabilitation Programme should be monitored by the ECO;
» Windlab should compensate farmers that suffer a permanent loss of land due to the establishment of the facility. Compensation should be based on accepted land values

for the area. The findings of the SIA indicate that the farmers affected by the proposed facility are being compensated for the loss of land. In addition they are being compensated for participating in the project.
Cumulative impacts: : Overall loss of farmland may impact on the livelihoods of the affected farmers, their families and the workers on the farms and their families.
Residual impacts: Refer to cumulative impacts.

Impact table summarising the significance of social impacts (with and without mitigation) associated with the operation phase of the wind energy facility

Nature: Creation of employment and business opportunities associated with the Operation phase

Based on information from similar studies, the proposed wind energy facility will employ approximately 90 full time employees over 25-year period. Approximately 25% of opportunities will be available to skilled personnel (forecasters, technicians, management and supervisory, etc), 35% to semi-skilled personnel (drivers, equipment operators), and 40% to low skilled personnel (road maintenance, security, etc). The proposed facility will therefore create potential employment opportunities in the Eastern Cape Province and Blue Crane Municipality. However, given that the wind energy sector in South Africa is relatively new it may be necessary to import the required operational and maintenance skills from other parts of South Africa or even overseas. However, 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 local employment and skills development contained in the Blue Crane IDP and LED programmes.

	Without enhancement	**With enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (30)**	**Moderate (39)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be enhanced?	Yes	

Enhancement Measures:

» Windlab should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project.

» Windlab, in consultation with relevant stakeholders, could investigate the opportunities for establishing a community trust. The establishment of a Community Trust does not only create potential benefits for local communities, but also addresses the issue of impact equity. In the case of the majority of renewable energy facilities, such as the Amakhala Emoyeni Wind Energy Facility, the directly affected landowner is compensated for the loss of land, while the adjacent landowners and communities bear the external costs associated with the visual impacts on the sense of place and the landscape character of the area.

Cumulative impacts:

Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area.

Residual impacts:

See cumulative impacts.

Nature: Potential impact on local tourism

This issue relates to the potential benefit to local tourism in the Blue Crane Municipality by creating a potential tourist attraction. A number of interested and affected parties interviewed indicated that the current tourism opportunities and attractions in the area were limited and that the establishment of the proposed facility could create an attraction and in so doing benefit local tourism in the area. The IDP Manager for the Blue Crane Route LM, Mr. Andile Ntshudu, indicated that the LM felt that the proposed facility would be positive for the broader area. However, he said there was debate around how exactly the Municipality would benefit from such developments.

However, a number of concerns were also raised. In this regard Ms. Ros Turner (Blue Crane Tourism) indicated that while she thought the facility development would be good for the area, there were concerns about noise and the impact the turbines would have on bird's as bird watching is a popular tourist activity in the area. Concerns were also raised by the BCDA regarding the visual impact of the proposed facility and the fact that the entire area had been identified for the development of wind energy facilities, and the potential impact that this could have on the hunting the area and the perception of hunters.

The findings of the Visual Impact Assessment indicate that the area acts as a major gateway for many tourists en-route to coastal holiday destinations as well as National Parks such as the Addo Elephant National Park. The facility would thus visually impact on various sensitive visual receptors that should ideally not be exposed to industrial style structures.

The VIA also indicates that there limited recommendations with regard to mitigation of the visual impact of the core facility, as there is no opportunity to place the wind turbines on lower ground, and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions. The potential land use conflict between the proposed facility and private nature reserves in the area are also highlighted.

With regard to the potential impact on private nature reserves, comments were received

from Mr Charles Price (Doorn Boom and East Cape Game Reserve) and Keith Gladwell (Woodlands Game Reserve). Mr Price indicated that the farm is currently used for hunting safaris, and that the visual and noise impacts associated with the proposed facility would have a negative impact on the current activities and future eco-tourism opportunities. However, he did acknowledge that alternative energy was the way of the future and sacrifices did need to be made when it can to promoting renewable energy. The potential impact on his operations was, however, a concern.

Mr Keith Gladwell indicated that he was very supportive of alternate energy and accepted that it was the way of the future. In this regard he would be very happy if a wind turbine could be sited on his farm to provide energy for his operations. The potential visual impacts are, however, a concern. In this regard the farm is traversed by a 135kv and 25kv and additional visual impacts associated with a wind energy facillity would ideally not be desirable. However, Mr Gladwell did indicate that the benefits of wind energy outweighed the negatives, with the exception of the visual impacts.

	Without enhancement / mitigation	**With enhancement / mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24) (Applies to both – and + impacts)**	**Low (27) (Applies to both – and + impacts)**
Status (positive or negative)	Positive (Potential to attract people to the area) Negative (Potential to distract from the tourist experience of the area)	Positive (Potential to attract people to the area) Negative (Potential to distract from the tourist experience of the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be Enhanced?	Yes	

Enhancement Measures:

» Windlab should liaise with representatives from the Blue Crane Municipality and local tourism representatives to raise awareness of the proposed wind energy facility.

» Windlab should establish a renewable energy interpretation centre at the site. The centre should include covered viewing area where passing visitors can stop and view the site. A similar system is employed at Eskom's demonstration facility at Klipheuwel near Durbanville in the Western Cape. The viewing site should be equipped with information boards that provide visitors with information on the project and other relevant information.

Cumulative impacts:

Potential benefit for tourism in the Blue Crane Municipal Area.

Residual impacts:

See cumulative impacts.

Nature: Promotion 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 one of the highest 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 carbon emissions.

The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is limited. However, the 400 MW produced will to some extent off-set the total carbon emissions associated with energy generation in South Africa. In addition the project is an independent power producer (IPP) that generated clean, renewable energy. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as significant.

	Without enhancement	**With enhancement**
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Very High (10)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**High (64)**	**High (72)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impacts be enhanced?	Yes	

Enhancement Measures:

» Use the project to promote and increase the contribution of renewable energy to the national energy supply.
» Maximise the public's exposure to the project via an extensive communication and advertising programme.
» 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.
» Investigate the opportunities for establishing a community trust.

Cumulative impacts:

Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

See cumulative impacts.

Nature: Impact on farming activities due to the establishment of a wind energy facility and the impact on farmers livelihoods

This issue relates to the potential long-term impact of the facility on existing farming activities, specifically the loss of grazing available for sheep and other livestock.

The significance of the impacts is to some extent mitigated by the fact that the farming activities in the area are confined to stock farming as opposed to crops. The experience with wind energy facilities is that livestock farming is not affected by operation of the facility. The final footprint of disturbance associated with wind energy facilities also tend to be small and is linked to the foundation of the individual wind turbines, services roads, sub-stations and power lines. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. The potential impact on farming activities is therefore not regarded as a significant issue.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status (positive or negative)	Negative	Neutral
Reversibility	Yes. Land that is lost to footprint associated with wind energy facility (roads, turbines etc) can be restored to farm land over time if rehabilitated.	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation Measures:

» The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop etc) should be minimised.
» An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.
» All areas disturbed by construction related activities, such as access roads, construction platforms, workshop area etc, should be rehabilitated at the end of the construction phase.
» The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed to establish the facility. The specifications for the rehabilitation programme should be drawn up the botanical specialists appointed as part of the EIA process.
» The implementation of the Rehabilitation Programme should be monitored by the ECO.

Cumulative impacts:

Potential minor loss of agricultural employment opportunities associated with loss of land.

Residual impacts:

See cumulative impacts.

Nature: Cumulative impacts associated with the establishment of more than one wind energy facility in the area and the potential impact on the areas rural sense of place and character of the landscape.

The cumulative impacts associated with the proposed wind energy facilities relate largely to the impact on sense of place and visual impacts. The area designated for the proposed wind energy facility projects is rural and agricultural in nature. The dominant land use activity in the area livestock farming (Cattle, Sheep and Goats). Game farming is also an increasingly important activity and there is agricultural crop and fruit cultivation along the Great Fish River. The proposed wind energy facilities will dramatically alter the sense of place and the existing landscape which will be dominated by turbines. However, the findings of the SIA indicate that the majority of landowners affected by the Amakhala Emonyeni wind energy facility felt the proposed wind energy facility would have a positive impact on the area and that the revenue generated from the agreement with Windlab would assist them to continue farming. It is assumed that this also applies to the two other wind energy facilities.

In terms of visibility to passing motorists, three key roads are located in the vicinity of the proposed wind energy facility sites namely, the N10 to the west that links Port Elizabeth and Middelberg via Cookhouse, the R63 to the north between Somerset East and Bedford via Cookhouse and the R350 to the east that connects Bedford and Grahamstown. In addition, there is one secondary gravel road (Patryshoogte) that runs through the northern section of the proposed sites and links Cookhouse and Bedford.

The N10 is an important road link between the Nelson Mandela Municipality (Port Elisabeth) to the south and the interior of the country, and is characterised by areas of high scenic beauty, particular within the Blue Crane Route Municipality. The proposed facility area will be potentially visible from the N10 at a number of places where the turbines are not screened by the natural topography. The R63 is a rural tarred road that links the N10 ~14km north east of Cookhouse. The proposed wind energy facilities and associated turbines will be visible on both sides of a 2.5km section of the road. The R63 is a relatively quiet road that is utilised mainly by local farmer and residents of Bedford. The R350 is a rural tarred road that is in very poor condition and is used primarily by local farmers to access Bedford in the North and Grahamstown in the South. The proposed wind energy facility site will be potentially visible from on both sides of a 7km section of the road. The Patryshoogte road in a secondary dirt road that bisects the proposed facility development area and links Cookhouse to Bedford. The road in used by local farmers to access these urban centres and the market via the N10.

The findings of the VIA (Appendix I) note that the combination of the Cookhouse Wind Energy Facility visual impact footprint with the Amakhala Emoyeni Wind Energy Facility is expected to form a stark and noticeable contrast within this predominantly rural to natural region.

The visual and cumulative impacts on landscape character are highlighted in the research undertaken by Warren and Birnie (2009). The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and dia metrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries. The paper also identifies two factors that important in shaping people's perceptions of wind energy facilities'' landscape impacts. The first of these is the cumulative impact of increasing numbers of wind energy facilities. The research found that if people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. This relates to people's perception and relationship with the landscape. In the South African context, the majority of South Africans have a strong connection with an affinity for the large, undisturbed open spaces that are characteristic of the South African landscape. The impact of wind energy facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of wind energy facility applications.

In summary, the proposed establishment of three wind energy facilities in the area will have a significant impact on the landscape and the areas rural sense of place and character. These impacts will be exacerbated by the large size of the proposed wind energy facilities (in excess of 200 turbines each) and their location. The cumulative impact of the proposed wind energy facilities has also been raised as a concern by the BCDA, specifically with regard to the potential impact on the hunting sector. As indicated above, it is not possible to effectively mitigate the visual impacts associated with wind energy facilities. As a result the Australian Guidelines stress the importance of general location and site selection.

	Without mitigation	**With mitigation**
Extent	Local and regional (4)	Local and regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (65)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation Measures:

» The establishment of more than one wind energy facility in the area is likely 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 wind energy facilities in the area, and the associated number of wind turbines. In addition, the siting of individual turbines on each of the wind energy

facility sites should be informed by findings of the VIA, specifically with respect to visual impact on farmsteads in the area and important roads.
Cumulative impacts: Impact on other activities whose existence is linked to linked to rural sense of place and character of the area, such as tourism, bird watching and hunting.
Residual impacts: See cumulative impacts.

Implications for Project Implementation

Most of the potential negative impacts on the social environment as a result of the construction and operation of the wind energy facility are expected to be of moderate to low significance, with implementation of the recommended mitigation measures. A number of positive impacts have been identified, which could be further enhanced if managed effectively. These benefits relate mostly to a temporary change in the employment and economic profile of the local area by means of employment opportunities, which in turn leads to a positive economic impact on local households, as well as the broader social benefits associated with the development of a clean, renewable energy.

Windlab should also establish 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 25-30 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.

6.8.1. Conclusions and Recommendations

Summary of social impacts during construction phase

Impact	**Significance No Mitigation**	**Significance With Mitigation**
Creation of employment and business opportunities	Moderate (Positive impact)	Moderate (Positive impact)
Presence of construction workers and potential impacts on family structures and social networks	Low (Negative impact for community as a whole) Medium-High (Negative impact of individuals)	Low (Negative impact for community as a whole) Medium-High (Negative impact of individuals)
Risk of stock theft, poaching and damage to farm infrastructure	Moderate (Negative impact)	Low (Negative impact)
Risk of veld fires	Moderate	Low

	(Negative impact)	(Negative impact)
Impact of heavy vehicles and construction activities	Low (Negative impact)	Low (Negative impact)
Loss of farmland	High (Negative impact)	Low (Negative impact)

Summary of social impacts during operational phase

Impact	**Significance No Mitigation**	**Significance With Mitigation**
Creation of employment and business opportunities	Moderate (Positive impact)	Moderate (Positive impact)
Impact on tourism	Low (Positive and Negative)	Low (Positive and Negative)
Promotion of renewable energy projects	High (Positive impact)	High (Positive impact)
Impact on farming activities	Low (Negative impact)	Low (Neutral impact)
Visual impact and impact on sense of place	Moderate (Negative impact)	Moderate (Negative impact)

The findings of the SIA indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. However, the visual impacts associated with facility will impact on the areas rural sense of place and landscape character. This impact will be for the entire operational lifespan of the facility. The potential for cumulative impacts also exists due to the proximity of the proposed African Clean Energy Developments (ACED) Cookhouse Wind Energy Facility and the Terrapower Cookhouse Wind Energy Facility. The ACED Wind Energy Facility has been authorised by DEA. These potential cumulative impacts do not, however, constitute a fatal flaw. However, it is recommended that the environmental authorities 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 wind energy facilities in the area. It is therefore recommended that the facility as proposed be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the report. The proposed establishment of three wind energy facilities in the area will have a significant impact on the landscape and the areas rural sense of place and character. The cumulative impact of multiple wind energy facilities on the rural landscapes is an issue that will need to be addressed by the relevant environmental authorities,

specifically given the large number of applications for wind energy facilities that have been submitted over the last 12 months.

When and if the wind turbine facility is finally decommissioned, the impacts are likely to be limited due to the relatively small number of permanent employees (90) affected. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

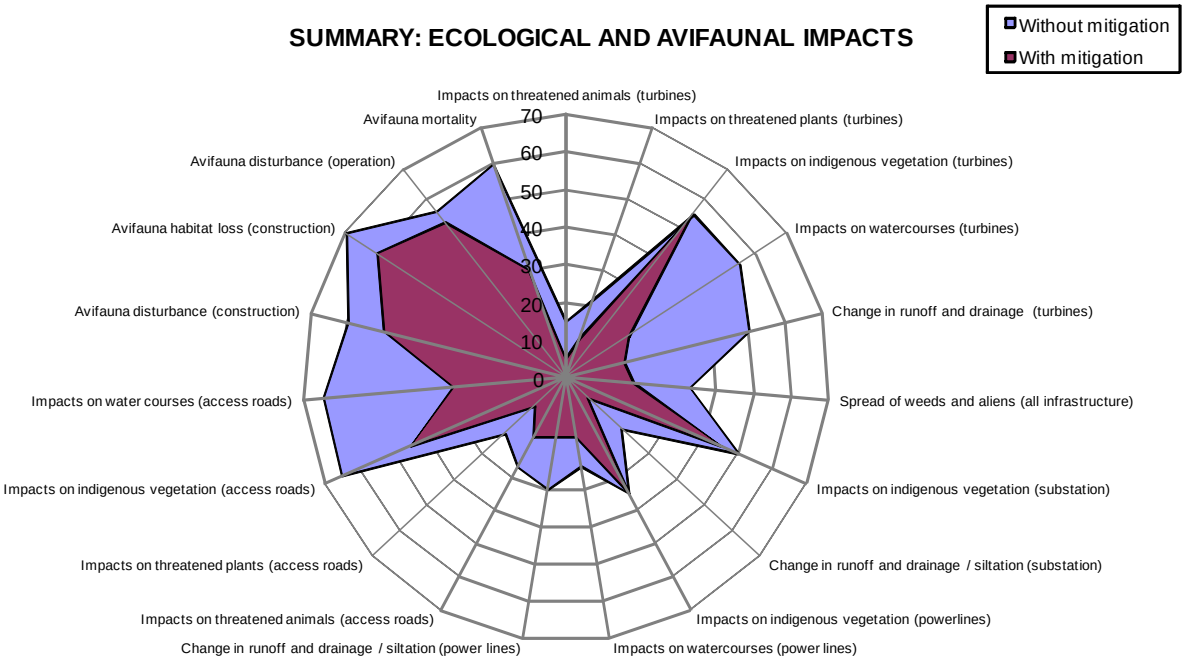
6.9. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process, the following provide a diagrammatic representation of the significance ratings for the potential ecological, visual and social impacts.

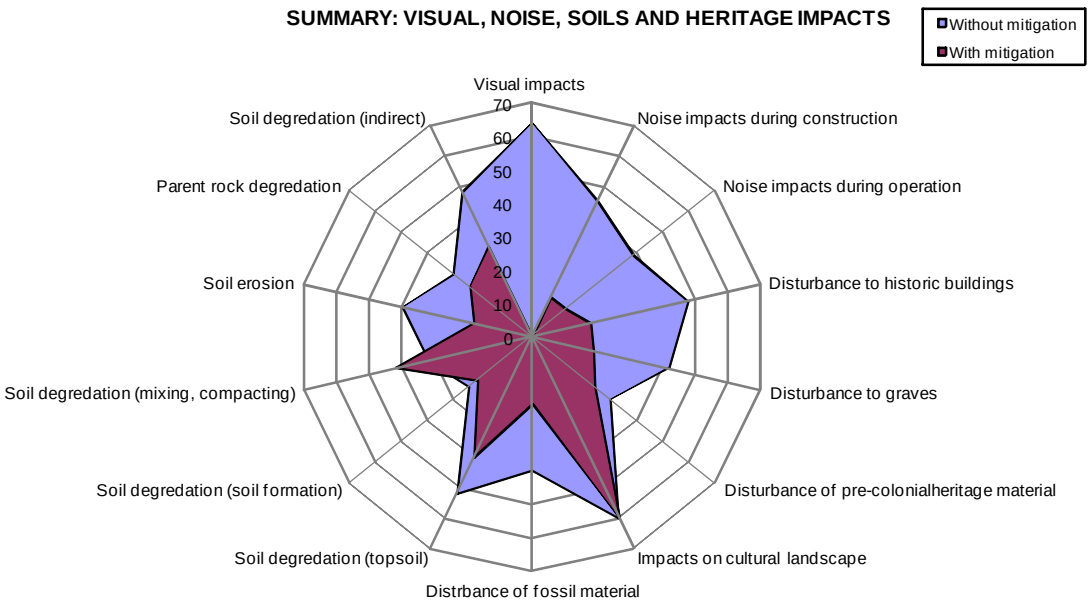
As indicated in Chapter 3, the significance weightings for potential impact have been rated as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Moderate (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

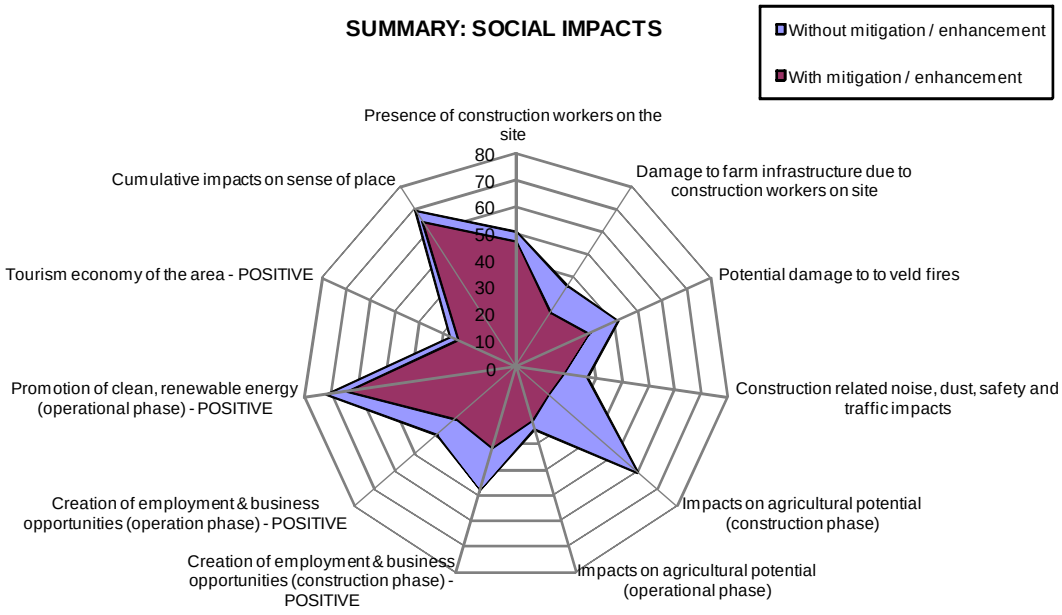
These ratings are illustrated on the axis of the graph. Impact ratings without mitigation are indicated in blue, and impact ratings with mitigation are indicated in purple.



Ecological impacts are primarily of moderate significance without mitigation. With the implementation of recommended mitigation measures, the impacts are reduced. Impacts on avifauna cannot be determined with confidence through this assessment, and monitoring of the interaction of the various species with the wind energy facility will provide further insight.



Impacts on potential heritage or fossil resources as well as noise impacts and impacts on soils are considered of moderate significance but in all cases can be reduced to low significance with the implementation of mitigation measures. The potential visual impacts will be of high significance with little opportunity for mitigation during operation of the facility.



Most of the potential negative impacts on the social environment as a result of the construction and operation of the wind energy facility are expected to be of moderate to low significance, with implementation of the recommended mitigation measures. A number of positive impacts have been identified, which could be further enhanced if managed effectively.

6.10. Assessment of Potential Cumulative Impacts

Cumulative impacts, in relation to an activity, refer to the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area. The cumulative impacts associated with the proposed wind energy facility can be viewed from two perspectives: 1) cumulative impacts associated with the scale of the project, i.e. that up to 350 turbines located on one site; and 2) cumulative impacts associated with other activities/developments in the area.

The potential *direct* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» Visual impact on the surrounding area at a local level.
» Noise impacts

The potential *indirect* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» Flora, fauna, avifauna and ecological processes – at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously.
» Increased pressure on roads and other infrastructure.

Cumulative effects have been considered within the detailed specialist studies, where applicable (refer to Appendices F - M) and are listed in the tables above.

In addition to the proposed Amakhala Emonyeni Wind Energy Facility, two other Wind Energy Facilities are proposed in the area between Cookhouse and Bedford within the Blue Crane Route Municipality, namely the proposed African Clean Energy Developments (ACED) Cookhouse Wind Energy Facility, and the Terrapower Cookhouse Wind Energy Facility. The ACED Wind Energy Facility has been authorised by DEA. The potential cumulative impacts associated with both the Amakhala Emoyeni Wind Energy Facility and the (authorised) Cookhouse Wind Energy Facility were evaluated through the EIA studies.

The cumulative impacts associated with the proposed wind energy facilities relate largely to the impact on sense of place and visual impacts. The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse Wind Energy Facility (up to 200 wind turbines) will increase the cumulative visual impact within the region. In this regard the proposed facilities will alter the areas sense of place and the landscape, which will be dominated by turbines. These impacts will be exacerbated by the large size of the proposed wind energy facilities (in excess of 200 turbines each) and their location. The cumulative impact of the proposed wind energy facilities has also been raised as a concern by the Blue Crane Development Agency (BCDA), specifically with regard to the potential impact on the areas hunting industry. However, the findings of the SIA also indicate that the majority of landowners directly affected by the Amakhala Emonyeni Wind Energy Facility felt the proposed facility would have a positive impact on the area and that the revenue generated from the agreement with Windlab would assist them to continue farming. It is assumed that this also applies to the two other sites.

The potential cumulative noise impacts with both the Amakhala Emoyeni and Cookhouse wind energy facilities operational were also evaluated. The findings of the Noise Impact Assessment (Appendix L) indicate there is significant potential that the cumulative effect from the two operational facilities would increase the potential noise impact experienced by potentially sensitive receptors. Subject to ACED (developer of the Cookhouse Wind Energy Facility) implement appropriate mitigation measures (as per the EIA recommendations), the mitigation measures as proposed in the Noise Impact Assessment would ensure that any cumulative impacts due to the operation of the Amakhala Emoyeni Wind Energy Facility is minimised. It should be noted that the representativeness and fairness of the cumulative assessment will be affected by the following:

- The neighbouring developer may not build their wind energy facility yet Windlab's approval could be affected by any cumulative assessment;
- The neighbour may not build the exact layout proposed in the EIA. Modification to the built layout will create different cumulative impacts;
- The neighbour's turbine type selection may differ from Windlab's.

The potential cumulative impacts do not, however, constitute a fatal flaw. It is therefore recommended that the facility as proposed be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the report. It is recommended that the environmental authorities 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 wind energy facilities in the area. In addition, the siting of individual

turbines on each of the wind energy facility sites should be informed by findings of the relevant Visual Impact Assessments, specifically with respect to the visual impact on farmsteads and important roads in the area.

In terms of potential impacts on avifauna the results of pre-construction monitoring must be applied to project-specific impact mitigation in a way that allows for the potentially considerable cumulative effects on the local/regional avifauna of multiple wind energy projects proposed for this area. Viewed in isolation, each of these projects may pose only a moderate potential threat to the local avifauna. However, collectively they may create a significant deterrent to continued occupation of the area by important populations of threatened species and a substantial barrier to energy-efficient travel between resource areas for such birds, as well as significant levels of artificial mortality in these populations, in collisions with what will be an extensive array of turbines, stretching across many regular flight paths. The impacts of this development must be viewed in the context of the potentially substantial, cumulative effects generated by multiple wind energy projects proposed for the immediate vicinity.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 7

Windlab Developments South Africa is proposing to establish the Amakhala Emoyeni Wind Energy Facility and associated infrastructure in an area between Cookhouse and Bedford in the Eastern Cape Province. A study area of approximately 273 km^2 is being considered as a larger study area for the construction of the proposed wind energy facility, and would include:

» Up to **350 wind turbines**.
» **Foundations** (of up to 20 x 20 x 2 m) to support the turbine towers
» **Underground cables** (where practical) between the turbines.
» Up to 3 **substations** (each of up to 250 x 200 m, two 33/132kV substations and one 33/132/220/400 kV substation) to facilitate the connections between the wind energy facility and the Poseidon Substation.
» Internal **access roads** to each turbine (4 - 6 m wide during construction, reduced to 3 – 4 m wide during operation).
» Two new sections of between 132kV overhead **power lines** and one new section of either 132, 220 or 400 kV power line feeding into the Poseidon Substation.
» On-site maintenance facility and visitor centre

The site proposed for the Amakhala Emoyeni Wind Energy Facility area falls within the Blue Crane Route Local Municipality, which falls under the Cacadu District Municipality of the Eastern Cape Province. The wind energy facility is proposed on the following farms: Portion 1, 2 and remainder of Farm 222, Portion 3 of Farm 203 (Platt House), Remainder of Farm 205 (Kop Leegte), Portion 1 of Farm 206 (Normandale), Remainder of Farm 168 (Stompstaart Fontein), Remainder of Farm 224 (Taai Fontein), Remainder of Farm 221 (Leeuw Fontein), Portion 2 and remainder of Farm 223 (Paarde Kloof), Remainder of Farm 227 (Wilgem Bush), Remainder of Farm 225, Portion 1, 2 and remainder of Farm 218 (Brakke Fonteyn), Remainder of Farm 259, Remainder of Farm 260, Portion 5 of Farm 149 (Great Knoffel Fonteyn), Remainder of Farm 242, Portion 1 and remainder of Farm 220 (Brak Fontein), Remainder of Farm 219 (Vogel Fonteyn), Remainder of Farm 169 (Olive Woods Estate), Portion 3 of Farm 141 (Brakfontein), and Portion 1 of Farm 187 (Kleine Knoffel Fonteyn).

The locality map showing provisional wind turbine layout, power line corridors and proposed substation sites is indicated below in Figure 7.1.

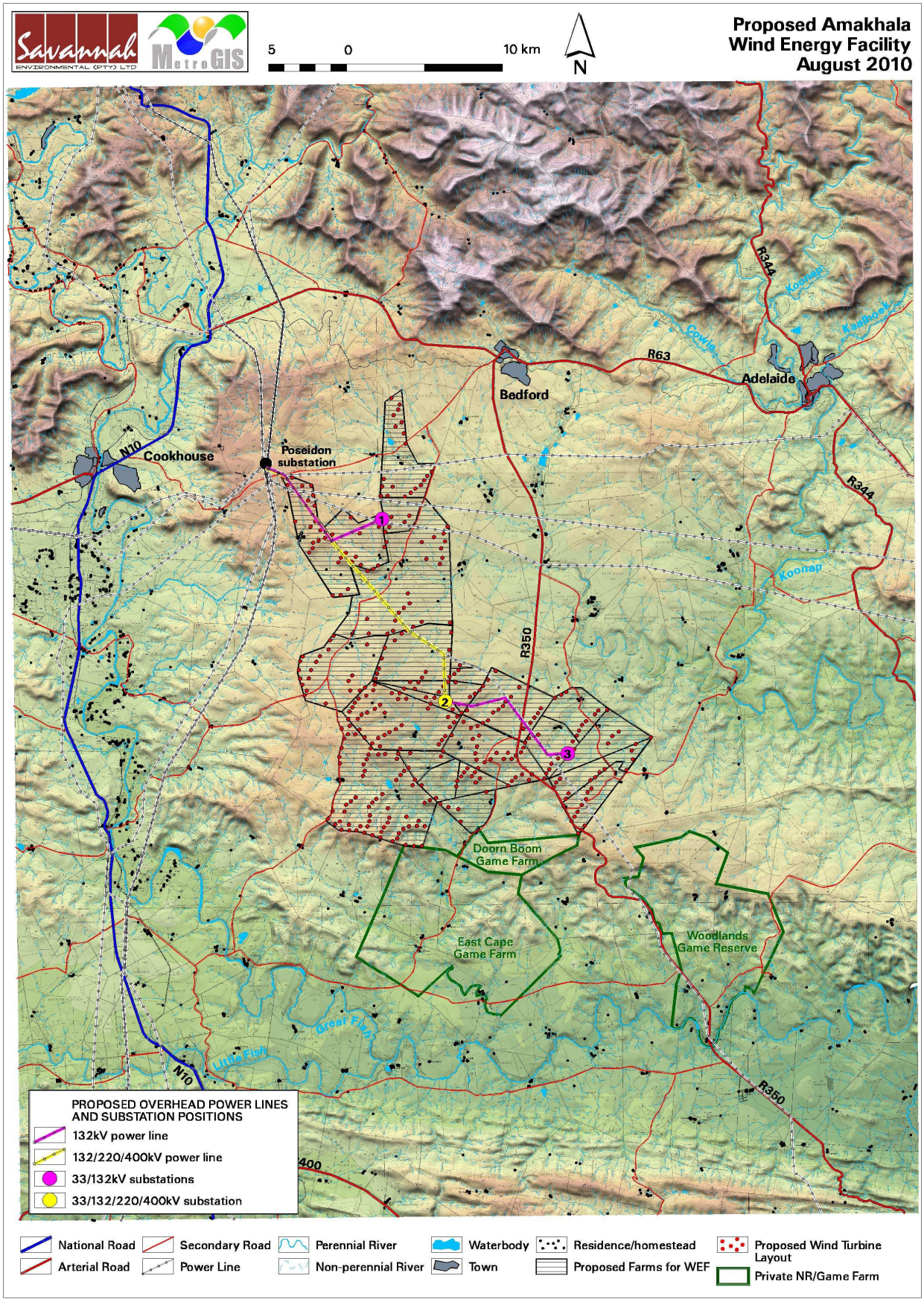


Figure 7.1: Locality map showing provisional wind turbine layout, power line corridors and proposed substation sites

The site for the proposed for the Amakhala Emoyeni Wind Energy Facility has been identified by Windlab Developments South Africa as a highly desirable site based on extensive pre-feasibility analysis. The site was selected through a detailed process of identification and elimination of sites based on a combination of attributes that are required for a suitable, viable and sustainable wind energy facility. This is performed by analysing wind energy facility attributes and constraints using computerised Geographical Information System (GIS) overlays including appropriate wind energy, environmental, topographical, infrastructure and residential information in combination, with a hand-picking process where the wind engineer applies detailed attention to areas of concern or potential, drawing on their experience of wind turbine siting issues that cannot be purely algorithmically defined.

Site selection draws on macro-level assessment of broad constraints, but also requires that micro-siting issues are considered in order to determine whether the project forms a cohesive unit that, as a whole, can constitute a potentially viable site. For example, a spread of positions where turbines might be situated which are too far apart may not render a wind energy facility possible.

The environmental impact assessment (EIA) for the proposed Amakhala Emoyeni Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Assess the proposed power line corridors and proposed substation sites put forward as part of the project.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. Every effort has been made to include representatives of all stakeholders in the study area in the public consultation process.

7.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - M provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Draft EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility; including the substations and power lines. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

In summary, the following summarises the potential impact and the assessed significance of these impacts for the wind energy facility and associated infrastructure:

» Overall, the proposed wind energy facility is likely to have a **moderate** local and regional negative impact on the **ecology** on site, prior to mitigation. This could be reduced to **moderate** – **low** negative after mitigation. The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation in development footprints, and long term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. Indirect factors include potential loss of habitat and damage to wetlands.
» The primary concern for the proposed facility in terms of **avifauna** will be that of collision of birds with the turbines and earth wires of the power lines. This is a medium-large wind energy project, proposed for a site with few significant conflicting issues in terms of its avifauna. Impacts on avifauna are likely to be of **high** significance prior to mitigation. With the implementation of mitigation measures this can be reduced to a more acceptable **moderate** significance. Although the development area does not impinge significantly on any known major bird fly-ways or unique landscape features, it will potentially affect populations of regionally or nationally threatened (and impact susceptible) bird species likely to occur within or close to the proposed turbine array. The facility may have a detrimental impact on these birds, particularly during its operational phase, unless significant commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to tolerable and sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South Africa avifauna. The

impacts of this development are also required to be viewed in the context of the potential cumulative effects generated by multiple wind energy projects proposed for the immediate vicinity.

» The overall impact of all the proposed activity on **geology and soils** is considered **moderate** negative without mitigating measures. With effective implementation of mitigating measures the impacts identified above can be reduced to a **low** level.

» The results of the **heritage** survey suggest that the area is of a **moderate** cultural sensitivity, however there are a number of recommendations which must be considered in order to reduce potential impacts on heritage resources from a medium to a more acceptable **moderate-low** significance. There is also the potential for impacts on fossil resources (palaeontology). This impact is potentially of **moderate** significance but can be reduced to **low** significance with the implementation of mitigation and monitoring measures.

» The placement of the facility and its associated infrastructure will have a **visual impact** on the natural scenic resources and rural character of this region. The visual impact index map clearly indicates the core area of potentially high visual impact within a 5km radius of the proposed facility. Potential areas of very high visual impact include the R350 arterial road and all the secondary roads. Within a 10km radius, visually exposed homesteads and settlements (sensitive visual receptors) represent sites of potentially very high visual impact. In terms of the protected areas in close proximity to the wind energy facility, the entire Doorn Boom Game Farm will be exposed to high and very high visual impact, as will the northern parts of the Eastern Cape Game Farm and a small section of the Woodlands Game Reserve. The primary visual impact, namely the appearance of the wind energy facility (mainly the wind turbines) is not possible to mitigate. Sections of the R350 arterial road and some secondary roads to the east of the site also have a very high visual impact rating due to the high frequency of observations of the project infrastructure by observers travelling along this road.

» The **noise impact** on surrounding areas (outside of the development footprint) are of **low** significance. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of **moderate** significance but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a **low** significance. Care must be taken to ensure that the operations at the wind energy facility do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

» Most of the potential **negative impacts on the social environment** as a result of the construction and operation of the wind energy facility are expected to be of **moderate to low** significance, with implementation of the recommended mitigation measures. A number of **positive impacts** have

been identified, which could be further enhanced if managed effectively. These benefits relate mostly to a temporary change in the employment and economic profile of the local area by means of employment opportunities, which in turn leads to a positive economic impact on local households, as well as the broader social benefits associated with the development of a clean, renewable energy.

No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However a number of issues requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix O. The most significant environmental impacts associated with the proposed project, as identified through the EIA, include:

» Visual impacts on the natural scenic resources of the region imposed by the components of the facility
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility
» Impacts associated with the access roads, substations and power lines
» Impacts on the social environment

7.1.1. Visual impacts on the natural scenic resources of the region imposed by the components of the facility

The construction and operation of the Amakhala Emoyeni Wind Energy Facility and its associated infrastructure will have a visual impact on the natural scenic resources and rural character of this region. Potential areas of very high visual impact include the R350 arterial road and all the secondary roads. Within a 10km radius, visually exposed homesteads and settlements (sensitive visual receptors) represent sites of potentially very high visual impact. Sections of the R350 arterial road and some secondary roads to the east of the site also have a high visual impact rating due to the high frequency of observations of the project infrastructure by observers travelling along this road. Certain farm settlements can also expect to be visually influenced (i.e. experience a potentially high visual impact) by the proposed facility, within a 10km radius of the development.

National and arterial roads that may fall within areas of potentially low visual impact include a section of the N10 south of Cookhouse, where partial views of the facility are expected, a small section of the R63 (between Bedford and Adelaide) and the section of R350 beyond the 5km radius from the proposed facility. All secondary roads south of the R63 and beyond the 10km radius are expected to be exposed to moderate visual impact. Roads traversing mountainous terrain (e.g. the Daggaboersnek mountain pass) within the region

may afford observers a clear, yet long distance (beyond 10km), view of the proposed development and may constitute low to very low visual impact.

Indications are that the development would not be visible from the town of Adelaide and that observers only on the outskirts of Cookhouse may have partial views of the wind farm from distances exceeding 10km, constituting a low potential visual impact. Similarly, the town of Bedford itself would not experience visual impact, but observers on the outskirts of the town may have partial medium distance views of the facility which will constitute a high visual impact. The Doorn Boom Game Farm will be exposed to high visual impact, as will the northern parts of the Eastern Cape Game Farm.

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The potential for mitigation is, therefore, low or non-existent. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.

7.1.2. Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility

A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of ~273 km^2 was considered for the facility. Due to the scattered nature of the wind energy facility infrastructure, the bulk of this area required for the facility footprint would not suffer any level of disturbance as a result of the required activities on site.

Permanently affected areas comprise the proposed turbine footprints (350 foundation areas of 20 m x 20 m in extent), access roads (to be rehabilitated to 4 m in width), three substations footprint (up to 200 m x 250 m in extent) and a maintenance facility (~400 m^2). The area of permanent disturbance is calculated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
350 turbine footprints (each 20 m x 20 m)	140 000
~ 174 km of permanent access roads (4 m in width)	696 000
Substation footprints (3 x 200 m x 250 m)	150 000
Maintenance facility	400
TOTAL	**986 400** (of a total area of ~273 000 000)

	= 0.36 % of site

Temporarily affected areas comprise the temporary laydown areas at each turbine (350 laydown areas of 60 m x 60 m) and a track of 11 m in width for the crane to move across the site (i.e. an additional 6 m width to the permanent road of 4 m in width). Internal access roads and underground cables are expected to follow the same alignments. The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
350 permanent laydown areas (each 60 m x 60 m)	1 260 000
Temporary crane travel (4 m) track adjacent to access road (6m in width) ~174km PLUS trench for cabling	1 740 000
TOTAL	**3 000 000** (of a total area of 273 000 000) **= 1.09 % of site**

Therefore, a total area of 3 986 400 m^2 (i.e. approximately 399 ha) can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to 1.5 % of the total ~273 km^2 area which will form part of the total wind energy facility site.

From the specialist investigations undertaken for the proposed wind energy facility development site, no absolute environmental 'no go' areas were identified. Nor were areas of *regionally* high or very high sensitivity identified. The thicket in the study area has been classified in the Succulent Thicket Ecosystems Programme as having elevated conservation value and, for that reason, has been classified here as having high sensitivity. Other factors that may lead to parts of the study area having high ecological sensitivity are the presence of watercourses and wetlands within the shallow drainage lines on site and the potential presence of a small number of plant and animal species of conservation concern. This applies primarily to the extreme southern parts of the study area on the scarp overlooking the Great Fish River.

Figure 7.3 illustrates the combined sensitivity map for the project study area. Indicated on the map are:

» High sensitivity ecological areas
» Heritage sites of high significance
» Homesteads (potentially sensitive noise receptors)

Figure 7.3 indicates an area of high ecological sensitivity. However, this area is not considered an exclusion area. The reasons for this include that limited

infrastructure is proposed within this area, and that the footprint occupied by the infrastructure is limited. Should mitigation measures be adhered to, impacts can be adequately managed.

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most significant impact. The proposed facility is likely to have a moderate, long-term impact on the avifauna of the area, and may negatively affect key rare, red-listed and/or endemic species. The most important negative impacts are likely to be on Cape Vulture, Denham's Bustard and Blue Crane. These birds (and other priority species) may be disturbed by construction of the facility, lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (bustards and cranes), or may suffer mortalities in collisions with the turbine blades and power lines (vultures, other raptors, bustards and cranes). Such effects can probably be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme, mainly involving careful and responsible development and management of the facility, with sensitivity to potential, negative impacts and a preparedness to adjust operating procedures in a sincere effort to mitigate such impacts.

Planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and underground cable alignments should coincide as much as possible.

The developer must consider the mitigation measures proposed in the heritage EIA assessment (Appendix J). Grave and burial areas must be identified and cordoned off before construction and an archaeologist should be appointed to inspect the exact and immediate surrounding area for possible sites once the final positions for the wind turbines and other infrastructure are known. An ECO should also be appointed during the construction phases to observe whether any depth of deposit and in situ archaeological material remains is uncovered. If at any stage during the construction phase any semblance of a fossil is observed, it would be necessary to stop the work immediately and report this occurrence to SAHRA and/or a professional palaeontologist.

The developer should consider the various mitigation options as suggested in the noise EIA assessment (Appendix L) to reduce the significance of the potential noise impact on any sensitive receptors to an impact of lower significance.

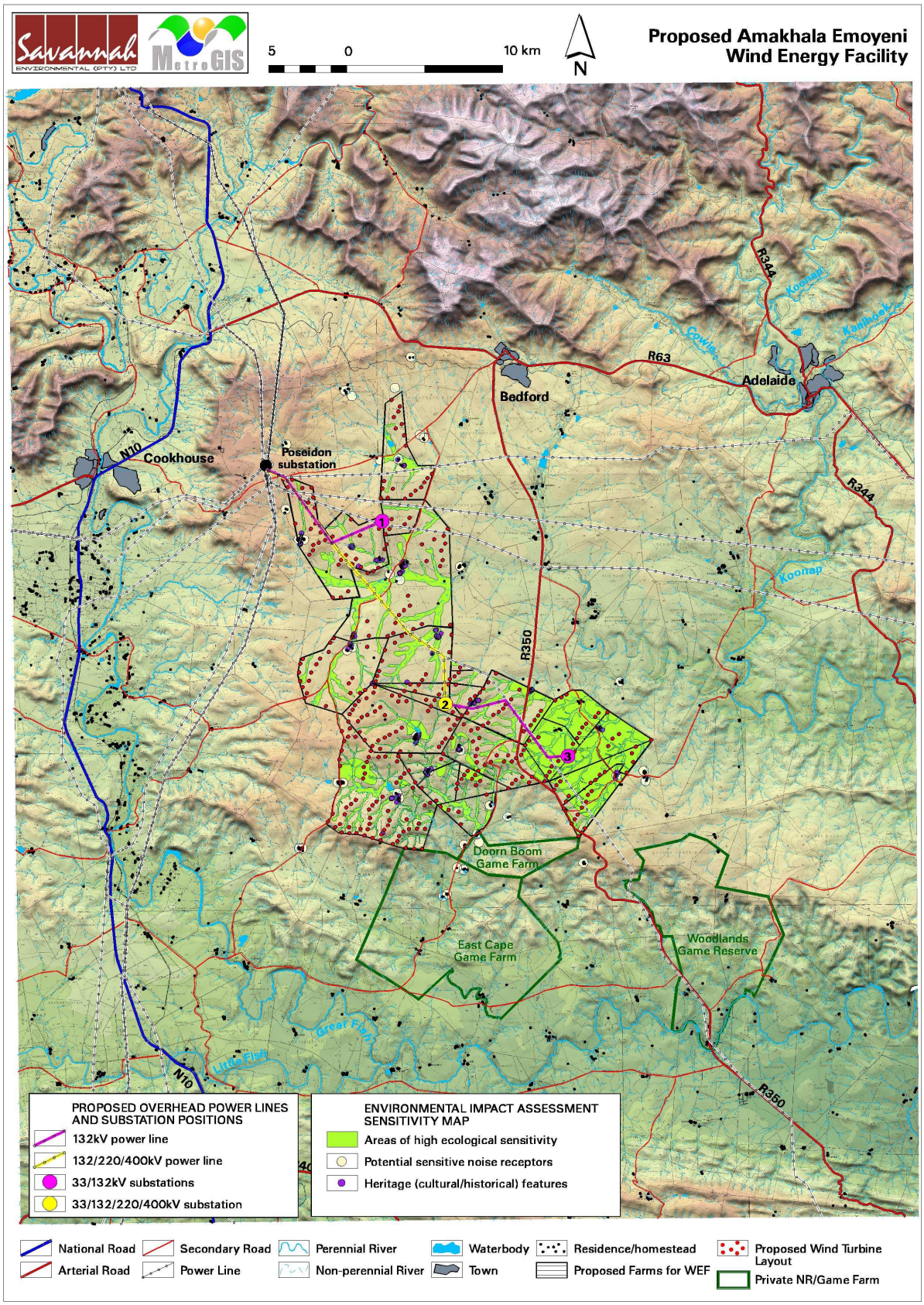


Figure 7.3: Combined sensitivity map for the project study area illustrating identified potentially sensitive areas in relation to the proposed wind energy facility layout

7.1.3. Impacts associated with the access roads, substations and power lines

There three substations and three new sections of overhead power line proposed, all to be constructed within the site footprint, without traversing any adjacent land. Therefore, no alternative power line routes/corridors or substation sites are being considered. The sensitivity of the power line routes, substation sites and access roads are assessed through the EIA, however.

Internal access roads are required for construction and operation (maintenance) of wind turbines). Where possible, they will run along any existing roads or vehicle tracks. There is ~ 174 km[1] of internal access roads proposed across the development footprint. The major impacts associated with the access roads will be the ecological impacts (potential impacts on wetlands, loss of habitat within indigenous natural vegetation types and spread of alien species), avifaunal impacts (habitat destruction and disturbance), and direct impacts on soil (soil erosion and degradation). These impacts can be successfully mitigated against if the mitigation measures proposed in the EIA specialist reports are implemented.

Three substations will be constructed within the site footprint. Each wind turbine will be connected to one of the three proposed substations by underground electrical cables (33 kV cables). Two new sections of 132kV overhead power lines and one new section of 400kV power line feeding into the Poseidon Substation will be required. The overhead power lines, the substations themselves and the related infrastructure placed within the facility are not expected to be highly noticeable amidst the much taller wind turbines and are therefore not expected to pose a significant visual impacts. Some localised visual impacts may occur during the construction phase as trenching and backfilling will occur, but these activities and their related impacts are not expected to be significant in comparison the construction of the wind turbines.

The construction of the power lines and substations will generally have medium to low impacts on the ecology of the study area.

Habitat destruction and disturbance with regard to avifauna associated with construction of the power lines and substations should be mitigated against. Electrocution on power line infrastructure has a potential impact on birds, which should be monitored through the proposed bird monitoring programme and mitigated through the use of bird diverters in areas where required.

[1] The approximate figure of 174 km was calculated by working out potential routes for access roads linking the turbines and calculating the combined length of all these roads.

Other impacts associated with the substation and power lines have been identified as being of low significance.

7.1.4. Impacts on the social environment

Based on the findings of the Social Impact Assessment, the landowners who stand to be directly affected by the proposed wind energy facility are not opposed to the development.

Impacts on the social environment are expected during both the construction phase and the operational phase of the wind energy facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the wind energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

On-site construction noise in unlikely to have a significant impact on any noise-sensitive receptors. The potential risk in terms of noise impact during the construction phase is relatively low. However, when more than one activity is taking place close to receptors, this risk will increase. No construction crew camp will be established on the site, and construction workers will be housed in neighbouring formal towns. Construction activities on the site will be restricted to daylight hours and the construction phase is anticipated to extend for a minimum 24-month period.

Impacts during the operation phase relate mainly to the visual impact imposed by the facility on the local environment (refer to Section 7.1.1 above). The potential noise impact during operation on number of sensitive receptors within the proposed wind energy facility footprint is potentially of moderate significance, but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a low significance.

The findings of the social impact study also indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures listed in the report to address the potential negative impacts during the construction and operation phases should also be implemented.

7.2. Overall Conclusion (Impact Statement)

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. The South African Government has set a 10-year cumulative target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro.

Through pre-feasibility assessments and research, the viability of establishing a 350-turbine wind energy facility on a site between Bedford and Cookhouse has been established by Windlab Developments South Africa. The positive implications of establishing a wind energy facility on the demarcated site within the Eastern Cape include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good wind energy resources at an inland site would be realised.
» The National electricity grid in the Eastern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Positive impacts on the tourism economy of the area.
» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the wind energy facility layout.
» The proposed substation positions and power line corridors are considered to be acceptable from an environmental perspective.
» Based on the findings of the Social Impact Assessment, none of the landowners who stand to be directly affected by the proposed wind energy facility are opposed to the development. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures listed in the report to address the potential negative impacts during the construction phase, specifically the presence of construction workers, should also be implemented.

» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

The impacts associated with the facility as proposed are acceptable from an environmental perspective, subject to the implementation of the recommended mitigation measures and management actions contained in the report. It is recommended that the environmental authorities consider the overall cumulative impact on the proposed facility, as well as the other facilities proposed for the area, in finalising their decision with regard to the potential for cumulative impacts to occur and the optimal number of wind energy facilities in the area.

7.3. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substations and distribution power lines, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Amakhala Emoyeni Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level. The visual impact associated with the facility is the primary impact which cannot be significantly mitigated, however the impact of high significance is restricted to within a distance of 10 km of the site.

The following infrastructure would be included within an authorisation issued for the project:

» Construction of the Wind Energy Facility with up to **350 wind turbine units**, and all **associated infrastructure** (access roads to site, internal access roads, workshop building)
» Construction of up to **three substations** on the site at the positions proposed in Figure 7.1.
» **Power lines** linking the wind energy facility to the Eskom electricity distribution network via the existing Eskom Poseidon Substation as proposed in Figure 7.1.

The following conditions would be required to be included within an authorisation issued for the project:

» As far as possible, wind turbines and associated infrastructure which could potentially impact on sensitive areas should a) be shifted within the site in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance); or b) where this is not practical or possible, alternative mitigation measures as detailed in this report must be implemented.
» Mitigation measures detailed within this report and the specialist reports contained within Appendices F to M be implemented.
» The draft Environmental Management Plan (EMP) as contained within Appendix O of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» A comprehensive stormwater management plan should be compiled for the substation footprints prior to construction.
» It is considered essential that the bird interactions which do take place with the establishment of the facility are fully documented. To this end, the initiation of a comprehensive pre-and-post commissioning monitoring programme, and a longer-term scheme for surveying bird movements in relation to the wind energy facility and fully documenting all collision (or electrocution with power line infrastructure/substation) casualties, is considered critical. Such a monitoring programme will also inform and refine any post-construction mitigation of impacts which might ultimately be required.
» It will be necessary to ensure that all dead stock are removed from the land (and perhaps relocated to safe 'restaurant' area for vultures at least 20 km from the site), and that all landowners within a wide radius (>10 km) of the facility are asked to do the same. This should reduce the numbers of vultures attracted to the area and lower collision risk.
» The developer must consider the mitigation measures proposed in the heritage EIA assessment (Appendix J). Grave and burial areas must be identified and cordoned off before construction and an archaeologist should be appointed to inspect the exact and immediate surrounding area for possible

sites once the final positions for the wind turbines and other infrastructure are known. An ECO should also be appointed during the construction phases to observe whether any depth of deposit and in situ archaeological material remains is uncovered. If at any stage during the construction phase any semblance of a fossil is observed, it would be vital to stop the work immediately and report this occurrence to SAHRA and/or a professional palaeontologist.

» Applications for all other relevant and required permits required to be obtained by Windlab Developments South Africa and must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any riparian vegetation or wetlands.

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