# ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
# FINAL EIA REPORT

# PROPOSED DORPER WIND ENERGY FACILITY ON A SITE NEAR MOLTENO

## EASTERN CAPE PROVINCE
## (DEA Ref No: 12/12/20/1778)

**FINAL EIA REPORT**
**October 2010**

**Prepared for:**

Dorper Wind Farm (Pty) Ltd
Facility to be developed by Rainmaker Energy Projects (Pty) Ltd
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## *PROJECT DETAILS*

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| **Title** | : | Environmental Impact Assessment Process<br>Final EIA Report: Proposed Dorper Wind Energy Facility on a site near Molteno, Eastern Cape Province |
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| **Project Developer** | : | Dorper Wind Farm (Pty) Ltd |
| **Report Status** | : | Final EIA report for authority review |

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# *PURPOSE OF THE FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT*

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd (Rainmaker). The proposed facility is referred to in this report as the Dorper Wind Energy Facility.

Dorper Wind Farm 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 Final 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 Dorper Wind Energy Facility project and the environmental impact assessment
**Chapter 2** describes the activities associated with the project (project scope). This chapter also describes wind energy as a power option and provides insight to technologies for wind turbines
**Chapter 3** describes the legal context and background with regard to the EIA process
**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 provided 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 now incorporates all issues and responses for 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 was made available for public review at the following public places in the project area from 17 September 2010 – 16 October 2010:

» Molteno Library
» Sterkstroom Library

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

## *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 the public feedback meeting held on 16 August 2010 at the Molteno Farms Union Building from 18:00 to 20:00.

# *SUMMARY*

## Background and Project Overview

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed facility is referred to as the Dorper Wind Energy Facility. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd.

Based on an extensive pre-feasibility analysis and site identification processes undertaken by Rainmaker Energy, a favourable area has been identified for consideration and evaluation as per the requirements of an Environmental Impact Assessment (EIA). The proposed site for the Wind Energy Facility is situated between the towns of Sterkstroom and Molteno along the R397 regional road. A cluster of up to 244 wind turbines, collectively referred to as a Wind Energy Facility is planned to be constructed over an area of approximately 13 200 ha (132 km2) in extent.

The wind energy facility is proposed on the following farms: Spreeukloof (portion 18), Paarde Kraal (portion 7), Uitekyk (portions 1 and 3), Farm 68 (portion 4), Cypher Gat (portions 1, 2, 3, 4, 5, 6, 7, and 9 and remaining extent), Highlands (remaining extent), Tolkop (portions 1 and 4) and Post Houers Hoek (remaining extent).

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. As local level environmental and planning issues were not assessed in sufficient detail through Rainmaker's regional-level site identification process, these issues have now been 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 244 wind turbine units (up to 90 m high steel tower and nacelle; up to 100 m diameter rotor - consisting of 3x50m blades);
» **Concrete foundations** (approximately 20m x 20m x 2m) to support the turbine towers;
» Underground electrical distribution cabling between the turbines;
» Up to four **substations** (the largest being up to 150 x 250 m) on the site in an appropriate position to receive generated power via underground distribution cabling from each wind turbine;
» **Power lines** (132 kV distribution lines) linking to the existing Eskom transmission grid
» An **access road** to the site from the main road/s within the area;
» **Internal access roads** to each wind turbine to link the turbines on site (approximately 3-6 m in width); and
» A **workshop area** for maintenance.

The proposed site has been identified by Rainmaker Energy Projects based upon a number of criteria set by significant preceding feasibility studies for wind projects in the Northern Cape, Western Cape, Kwazulu-Natal, and Eastern Cape. Rainmaker has analysed the localised area and has deduced that from their initial feasibility assessments that the proposed site is appropriate when considering the financial viability of a project of this nature in the area, as well as both environmental and social considerations.

The site displays specific characteristics which make it a preferred site for a wind energy facility.

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.

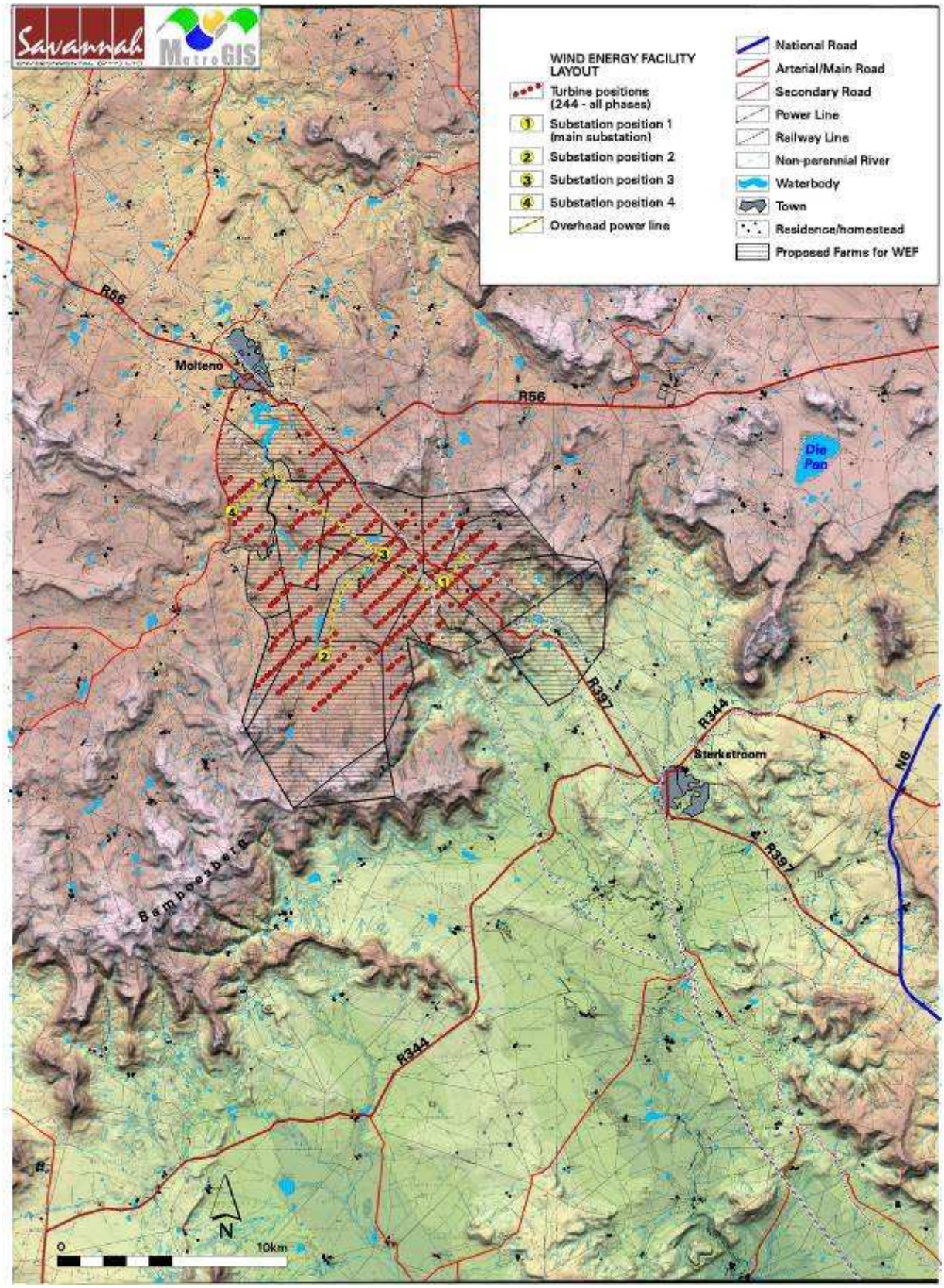


**Figure 1:** Locality map showing provisional wind turbine layout, proposed substation sites and routes for power lines.

## Environmental Impact Assessment

The proposed Dorper 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 12/12/20/1778). 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**

Overall the proposed wind energy facility is likely to have a medium local and regional negative impact on the ecology on site, prior to mitigation. This could be reduced to medium - low 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 direct, long-term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. during the construction phase.

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 impact on avifauna is potentially of medium - high significance, but could be reduced to a medium - low significance with the implementation of mitigation measures. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined, from pre-construction and into the operational phase of the project. Refer to EMP (Appendix O) for an outline of the proposed bird monitoring programme.

The findings of the geology and soils study indicate the most important impacts on geology and soils include soil degradation (including erosion). The significance of the main direct impacts that have been identified is considered low to moderate due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. A basic assessment of the potential geotechnical constraints on the project indicates no insurmountable problems which have may have an impact on the design and construction processes.

The results of the heritage survey suggest that the impacts associated with turbine and other infrastructure footprints would have a low impact on the archaeological material in the study area. There is also the potential for impacts on fossil resources as the area is fossil-rich, this impact is potentially of high 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. Potential visual impacts are of high significance (i.e. the facility will be highly visible) within 5km from the turbines. Homesteads and settlements 5km to 10km from the development may experience low to moderate visual impacts. The towns of Molteno and Sterkstroom are not expected to experience a significant visual impact. The visual impact of the core facility (mainly the wind turbines) is not readily mitigated due to the size of the structures in the landscape.

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 high significance on five of the identified sensitive receptors, 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.

**Conclusions**

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

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 Dorper Wind Energy Facility on a site near Molteno 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 5 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 **244 wind turbine units**, and all **associated infrastructure** (access roads to site, internal access roads, workshop building)
» Construction of up to **four substations** on the site.
» **Power lines** linking the wind energy facility to the Eskom electricity distribution network via the existing Eskom power lines traversing the site.

The following conditions would be required to be included within an authorisation issued for the project:

» Mitigation measures detailed within this report and the specialist reports contained within Appendices F to N 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.

» A monitoring program should be initiated in order to collect data on the numbers of birds affected by the wind energy facility.
» A monitoring programme should be implemented to document the effect on bats.
» The developer should consider the various mitigation options as proposed in the noise assessment to reduce the significance of the potential noise impact on any sensitive receptors.
» A qualified palaeontologist should be commissioned to carry out a field scoping study of the entire study area before construction commences.
» Applications for all other relevant and required permits required to be obtained by Dorper Wind Farm 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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## 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

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd (Rainmaker). The proposed facility is referred to in this report as the Dorper Wind Energy Facility. Based on an extensive pre-feasibility analysis and site identification processes undertaken by Rainmaker Energy, a favourable area has been identified for consideration and evaluation as per the requirements of an Environmental Impact Assessment (EIA). The proposed site for the Wind Energy Facility is situated between the towns of Sterkstroom and Molteno along the R397 regional road. A cluster of up to 244 wind turbines, collectively referred to as a Wind Energy Facility is planned to be constructed over an area of approximately 13 200 ha (132 $km^2$) in extent.

The facility would be operated as a single facility and would include the following: up to 244 wind turbine generators, internal access roads, up to four substations and distribution power lines linking to the existing Eskom transmission network in the vicinity of the proposed facility.

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 Final 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 90GW in 2008, with total world installed capacity having doubled 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.

The proposed Dorper Wind Energy Facility between Sterkstroom and Molteno will be registered with the United Nation's Framework Convention for Climate Change as part of the Clean Development Mechanism Programme.

It is considered viable that long-term benefits for the community and/or society in general can be realised should this site prove to be acceptable from a technical and environmental perspective for the potential establishment of a wind energy facility. In the event of the 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).

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 create needed energy generation capability in the region. The justification for the development of a project on a site in this area is discussed in more detail in Chapter 2.

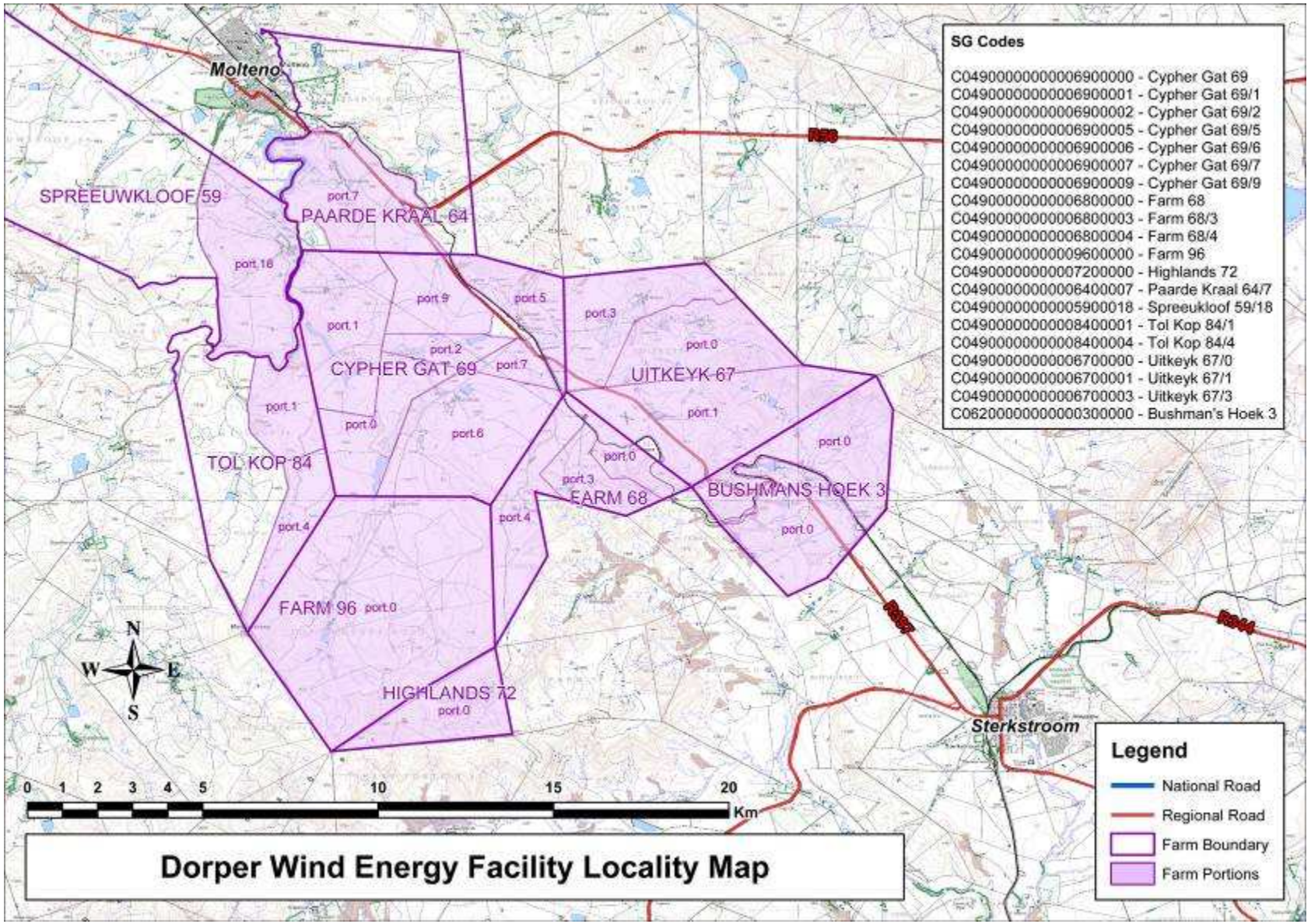



**Figure 1.1:** Locality map indicating the proposed development site for the proposed Dorper Wind Energy Facility

## 1.2. Project Overview

The proposed site being considered for the development of the wind energy facility near Molteno falls under the Inkwanca Local Municipality. Farming practises and agricultural lands dominate the general land use character of this region. The study site is situated approximately 2 km south-east of the town of Molteno.

The wind energy facility is proposed on the following farms: Spreeukloof (portion 18), Paarde Kraal (portion 7), Uitekyk (portions 1 and 3), Farm 68 (portion 4), Cypher Gat (portions 1, 2, 3, 4, 5, 6, 7, and 9 and remaining extent), Highlands (remaining extent), Tolkop (portions 1 and 4) and Post Houers Hoek (remaining extent).

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**. As **local level environmental and planning issues** were not assessed in sufficient detail through Rainmaker's regional-level site identification process, these issues have now been 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 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 244 wind turbine units (up to 90 m high steel tower and nacelle; up to 100 m diameter rotor - consisting of 3x50m blades);
- Concrete foundations (approximately 20m x 20m x 2m) to support the turbine towers;
- Underground electrical distribution cabling between the turbines;
- Up to four substations (the largest being up to 150 x 250 $m^2$) on the site in an appropriate position to receive generated power via underground distribution cabling from each wind turbine;

» Power lines (132 kV distribution lines) linking to the existing Eskom transmission grid
» An access road to the site from the main road/s within the area;
» Internal access roads to each wind turbine to link the turbines on site (approximately 3-6 m in width); and
» A workshop area for storage and maintenance.

The scope of the proposed Dorper Wind Energy Facility near Molteno, 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 Dorper Wind Energy Facility 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 12/12/20/1778). 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. Dorper Wind Farm (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 30$m^3$ but less than 1 000$m^3$ at any one location or site. |
| Government Notice R386 (21 April 2006) | 13 | The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded. |

## 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 provided 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 now incorporates all issues and responses raised during the public review of the draft EIA Report for to submission to DEA.

This EIA Report consists of the following sections:

**Chapter 1** provides background to the proposed Dorper Wind Energy Facility project and the environmental impact assessment
**Chapter 2** describes the activities associated with the project (project scope). This chapter also describes wind energy as a power option and provides insight to technologies for wind turbines
**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 Dorper Wind Farm 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 Dorper Wind Farm or Rainmaker Energy Projects. 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 undertaken the EIA process and reporting for the Eskom Holdings Limited 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

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed facility is referred to as the Dorper Wind Energy Facility. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd.

A study area of approximately 132 $km^2$ is being considered as a larger study area for the construction of the proposed wind energy facility, and would include:

» Up to 244 **wind turbine** units (up to 90 m high steel tower and nacelle; up to 100 m diameter rotor - consisting of 3x50m blades);
» **Concrete foundations** (approximately 20m x 20m x 2m) to support the turbine towers;
» Underground electrical distribution cabling between the turbines;
» Up to four **substations** (the largest being up to 150 x 250 m) on the site in an appropriate position to receive generated power via underground distribution cabling from each wind turbine;
» **Power lines** (132 kV distribution lines) linking the 4 substations directly into the existing Eskom transmission lines traversing the site;
» An **access road** to the site from the main road/s within the area;
» **Internal access roads** to each wind turbine to link the turbines on site (approximately 3-6 m in width); and
» A **workshop area** for storage and maintenance.

The wind energy facility is proposed on the following farms: Spreeukloof (portion 18), Paarde Kraal (portion 7), Uitekyk (portions 1 and 3), Farm 68 (portion 4), Cypher Gat (portions 1, 2, 3, 4, 5, 6, 7, and 9 and remaining extent), Highlands (remaining extent), Tolkop (portions 1 and 4) and Post Houers Hoek (remaining extent). The site and proposed infrastructure is illustrated on Figure 2.1.

This chapter provides details regarding the scope of the proposed Dorper Wind Energy Facility near Molteno. 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.

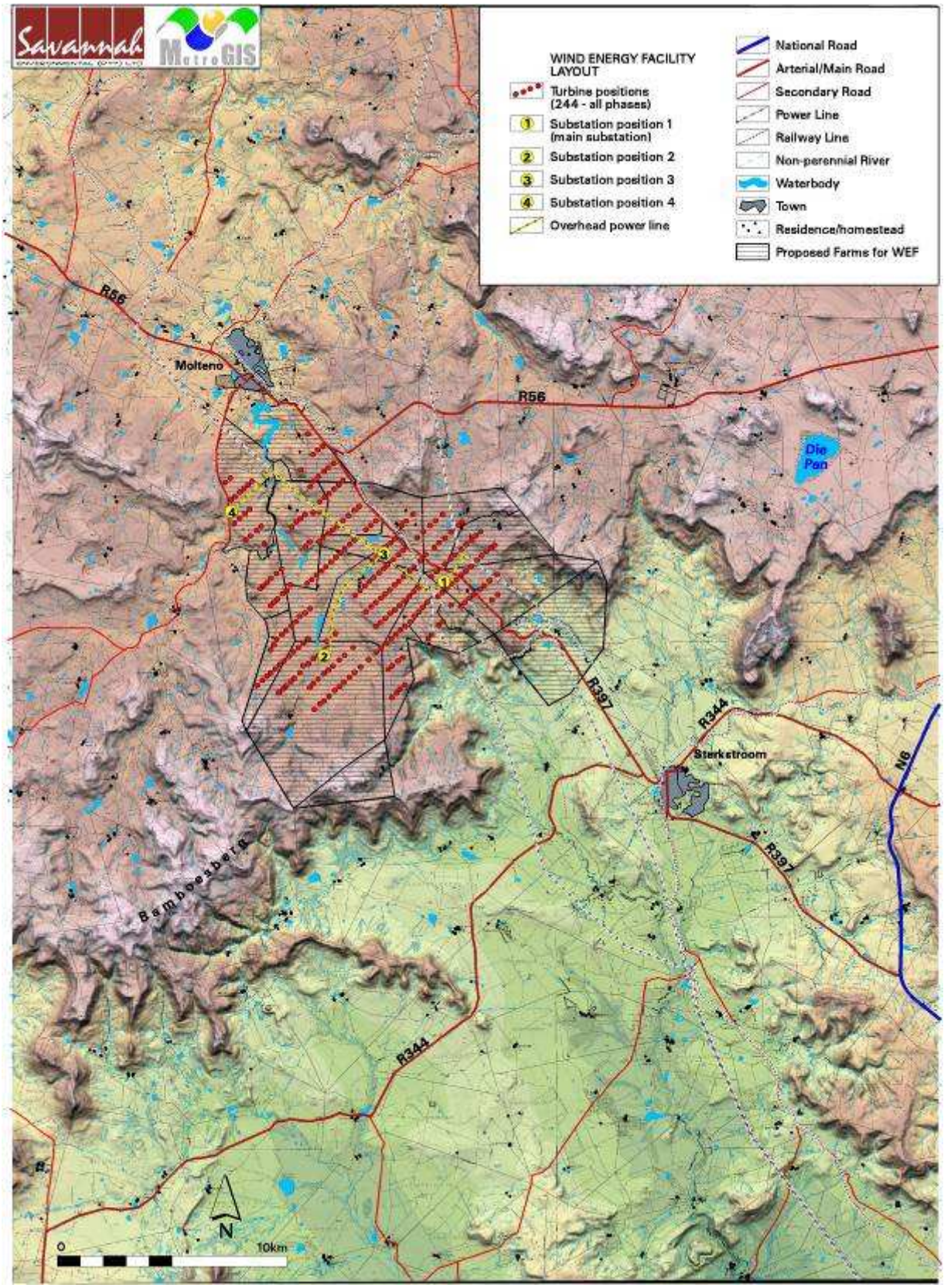



**Figure 2.1:** Locality map showing the properties included in the development site, as well as a provisional wind turbine layout, power line corridors and proposed substation locations within the development footprint

## 2.1. Rationale for Site Alternative

The proposed site has been identified by Rainmaker Energy Projects based upon a number of criteria set by significant preceding feasibility studies for wind projects in the Northern Cape, Western Cape, Kwazulu-Natal, and Eastern Cape. Rainmaker has analysed the localised area and has deduced that from their initial feasibility assessments that the proposed site is appropriate when considering the financial viability of a project of this nature in the area, as well as both environmental and social considerations. The site-specific environmental impacts for the site are now considered through the EIA process.

The site displays specific characteristics which make it a preferred site for a wind energy facility. These are explored in further detail in the table below:

**Table 2.1:** Site characteristics

| Considerations | Details for Proposed Site |
|---|---|
| *Topography and site extent* | The proposed site, being both in a valley, and adjacent to a plateau, has a significant wind-funnelling effect. As a result Rainmaker Energy Projects calculates that at least 25-40% more energy will be produced when compared to sites further along the same plateau which have (wind) obstructions and an absence of features which produce this funnelling effect.<br><br>Furthermore, the proposed site already has significant transmission capability, which further enhances the consideration and suitability for a wind energy facility.<br><br>The site covers in excess of 13 300 hectares, with matching transmission, which allows for a large installed capacity. |
| *Environmental Considerations* | An EIA was performed for the installation of the 400KV Beta-Delphi Transmission line, the construction of which was completed in August 2007. The EIA clearly indicates the suitability of this particular valley for construction of the power line, as opposed to an alternative route 20 km to the east of the proposed site. These reasons included, *inter alia*, a lower visual impact for the chosen site area, tourism potential for the alternative and ecological considerations such as the number of pans in the alternative route. Finally, the EIA found that the route selected (which runs through the proposed Dorper Wind Energy Facility site), was regarded as being previously disturbed by agriculture, making it more suitable for the transmission power line alignment. |
| *Land use* | The area of the proposed site consists of vegetation which has been previously disturbed by agricultural activities, and is used for stock farming. In addition, it is proposed that, when operational, |

| | |
|---|---|
| | the wind energy facility will not impact on the production capability of the farms. |
| *Potential Visual Impacts* | The proposed site is unique in that it lies in a valley, which is then on a plateau. As such it is expected that the wind turbines shall have significantly less visual effect and visual carry than most potential wind projects in South Africa. A visual impact assessment is still being conducted for the site (Appendix K). |
| *Power transmission considerations* | The proposed site has existing transmission lines running through it, suitable for a wind energy facility of this size. As a result, a direct connection point could potentially be made on the site, without any further need for the construction of power lines over adjacent land.<br><br>Currently, all power in the Eastern Cape is generated by coal power stations situated in the provinces of Limpopo and Mpumalanga. Generation of power in the Eastern Cape at the site proposed for Dorper Wind Energy Facility should, therefore reduce existing line losses. This is supported by the National Electricity Regulator of South Africa (NERSA) who, in conjunction with Eskom, developed an Integrated Resource Plan (IRP) for electricity in South Africa where they demonstrated that by reducing the load in East London, results in a net 25.3% savings. |
| *Industry and Economic Stimulus* | The proposed wind energy facility will create much-needed economic stimulus in the Eastern Cape region, without the need for major infrastructure upgrades in the form of new roads, ports or transmission.<br><br>The proposed site is located within the proximity of Molteno, Sterkstroom and Queenstown. The proposed project has the potential of stimulating employment (requiring labour from the local area), as well as having the knock-on-effects of creating local industry in the form of the service teams required to support the project. The Eastern Cape has a negative population growth as a result of emigration to surrounding provinces and Rainmaker Energy hopes, through the proposed project, to create an additional economic pull into the region. |
| *Regional and South African Power situation* | The Eastern Cape has limited power generation capability. A project of this nature will create new energy generation capability to the region. South Africa is also going through a major power shortage, needing large investments in new power projects. This site yields a high wind regime, therefore creating very reliable and predictable wind energy over the winter periods. |
| *Site Access* | The proposed site is well-situated for construction of a wind facility, having a relatively flat topography. Two major roads (N6 and R397) would enable the transport of wind turbines and allow for ease of transport between the site and major ports. |

From the pre-feasibility analysis and site identification process undertaken by Rainmaker Energy Projects (refer to Appendix F), Rainmaker Energy consider the site a highly preferred site for wind energy facility development. No further siting alternatives have been considered in this EIA process.

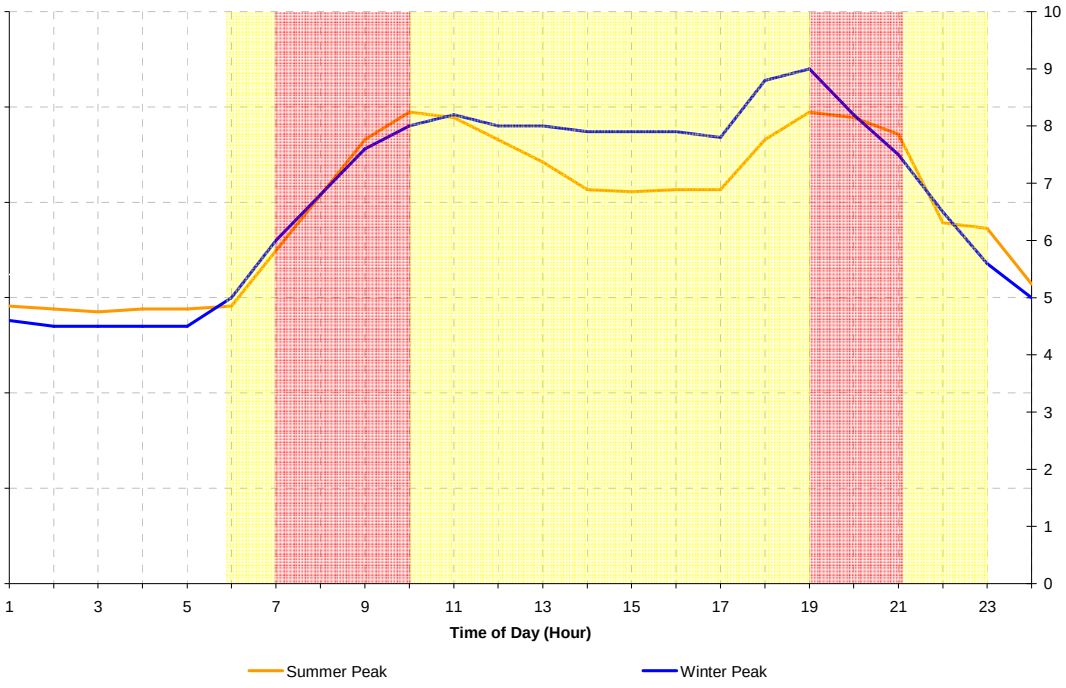
Rainmaker's site selection process has been based on finding sites with a) minimum potential environmental impact, b) existing infrastructure, and c) aligning this with finding the wind profiles (and resulting energy produced) that maximise energy output for South Africa's needs.

An added important criteria in site selection was to ensure that the power generation profile of the site matches to that of South Africa's load requirements, therefore ensuring not only that the wind site assists to reduce South Africa's reliance on fossil fuels, but also ensures the alleviation of the possible power shortage faced by the country. Rainmaker's analysis of various wind sites around South Africa shows even wind sites with the same annual energy output can have a significantly different effect on South Africa's power situation. Rainmaker has found that the optimal site for a wind energy facility should have the following characteristics, namely:

» The wind energy facility generates power when power is required (i.e. during the day and during peak periods).
» The wind energy facility generates more power over winter, when power consumption is substantially higher at times than in summer, and when South Africa's electricity supply and demand is at its most fragile.
» Stronger wind generation when the overall country is experiencing a cold spell as the country tends to experience electricity consumption peaks (and the resultant electricity generation strain countrywide) over these periods.

Rainmaker's experience is that sites with wind energy potential in South Africa are typically either 'summer sites' or 'winter sites'. These are sites where the more reliable energy is delivered in either summer or winter. The development of a 'winter site' would, therefore, be preferred over the development of a 'summer site', as the winter season is when power generation is required most in the country because of the increased demand for power by users over this period. This is also an area where solar energy will always play a smaller role. This line of thinking is further reinforced by the Megaflex tariff structure (the tariff that large users such as municipalities and larger industrial users pay), where electricity is priced according to when it is used (i.e. the time of use), as well as whether it is used in winter or summer periods (winter tariffs are double that of summer tariffs).

Figures 2.2 to 2.4 below illustrate the load profile for South Africa (Figure 2.2), the load profile of a typical South African wind site (Figure 2.3), and the potential energy to be generated by the proposed Dorper Wind Energy Facility (Figure 2.4).




The Megaflex periods (red peak tariff, yellow standard tariff and white off-peak times) are overlaid onto this graph to further reinforce the value of electricity in South Africa at different times in the day. During the winter months, electricity as per the Megaflex tariff is double that of the summer tariff.

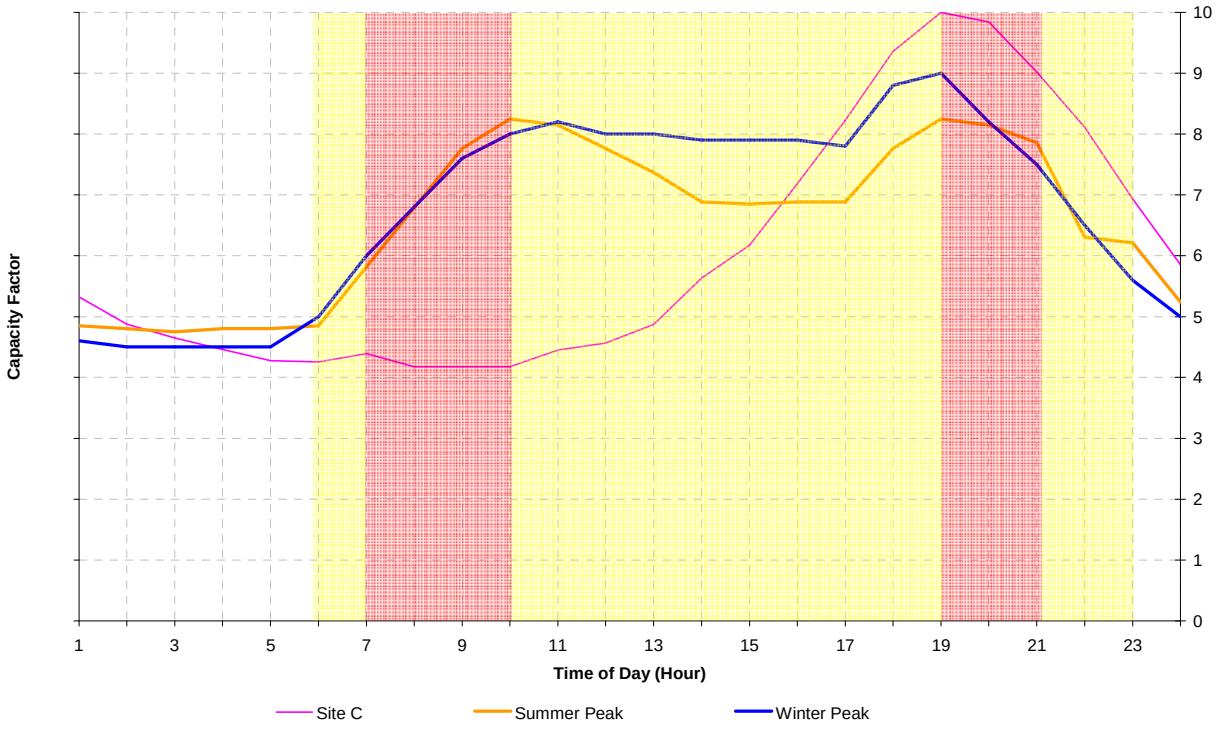



**Figure 2.3.** Load profile of a typical South African wind site. The graph shows an energy profile of a typical coastal site (pink line marked as Site C) where the overall energy yield is substantially lower

than Dorper (i.e. for every turbine installed on Dorper, more energy will be produced), even though it has a high peak power. When energy is produced, it does not match the load profile (i.e. the typical wind pattern tends to increase in the afternoon). Finally, the majority of this wind energy is produced in summer, when overall consumption drops.

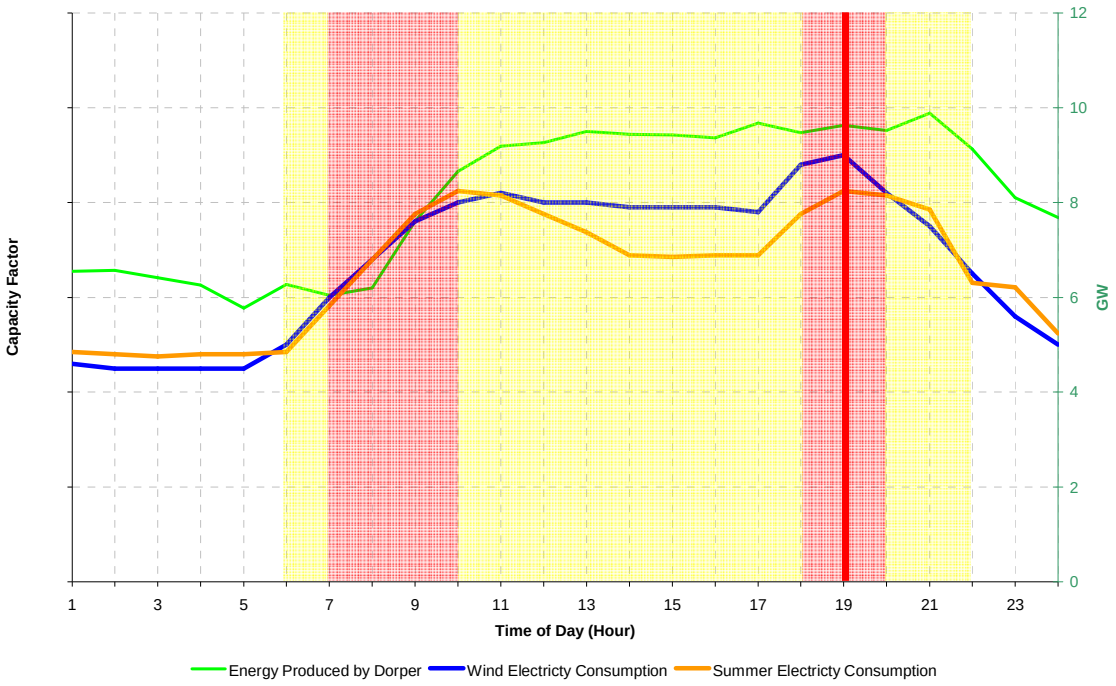



**Figure 2.4.** Energy produced by the proposed Dorper Wind Energy Facility. This graph shows the Energy Produced (Mean energy production) for the facility, as well as highlighting the energy production over winter. The profile matches the consumption pattern. Furthermore, winter production is extremely reliable and matches consumption. The colder South Africa's temperature, the higher the energy production, following consumption patterns where energy use increases during cold periods.

Sites such as the site proposed for the Dorper Wind Energy Facility are, therefore, considered desirable from a power generation perspective as they:

» Provide power during the day and peak periods.
» Provides reliable power during winter and cold spells, typically when the power is needed most.
» High yields (i.e. capacity factors) ensure that more power (KWh's) are generated per wind turbine, thus reducing the number of wind turbines needed per KWh generated.

Appendix F provides further information on the site identification process and site energy profiles undertaken by Rainmaker Energy Projects.

### *2.1.1. Site-specific Layout Design Alternatives*

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 turbine micro-siting information was provided to inform the specialist impact assessments.

New 132 kV distribution power lines are proposed to connect the individual substations within the facility to the Main on-site substation, which will connect directly into the existing Eskom 400 kV Beta-Delphi transmission line traversing the site (refer to Figure 2.1). These new power lines are all restricted to the site development 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.

### 2.1.2. The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the wind energy facility on the proposed site near Molteno.

The 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.

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 the following:

**Table 2.2** Socio-economic and environmental benefits of renewable energy

| | |
|---|---|
| *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 insolation 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. |

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.

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. DME's macroeconomic study of renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) 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)).

Through research, the viability of a wind energy facility has been established, and Dorper Wind Farm proposes that up to 244 turbines can be established as part of the facility near Molteno. 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.

This is, therefore, not a preferred alternative and not assessed in further detail.

## 2.2. Technology Alternatives

Besides the significant consideration in selecting the site of an appropriate and viable wind facility in this area, Rainmaker Energy Projects has considered alternative power generation technologies. Though the area has a known coal reserve, this coal is generally of poor quality, is expensive and challenging to mine, and will be of significant environmental consideration should it be mined. Other renewable power generation technologies in the Eastern Cape, such as solar photovoltaic (PV) or concentrated solar thermal (CSP) are not seen to be appropriate for the region for lack of direct solar resources, as well as limited water resources (needed for CSP).

Wind energy as a power generation technology can be regarded as one of the most cost-effective energy sources for power generation in this area of South Africa, and has further advantages by offsetting carbon and air pollution, as well requiring negligible water usage during operation.

Rainmaker Energy Projects will consider various wind turbine designs and finalise the layout in order to maximise the capacity of the site. The turbines being considered for use at this wind energy facility are proposed to be between 2MW and 3MW in capacity. The turbines will have a hub height of up to 90m and a rotor diameter of up to 100m (i.e. each blade up to 50m in length). The technology provider has not yet been confirmed and will be decided after further wind monitoring and analysis and a detailed tender process.

## 2.3. Wind Energy as a Power Generation Technology

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.

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 now is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

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.

**Wind speed** is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. With a doubling of average wind speed, the power in the wind increases by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind energy facility (for example, an increase of average wind speed from 22 km/hr to 36 km/hr (6 m/s to 10 m/s) increases the amount of energy produced by over 130%). 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 to 17 m/s). Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain.

**Wind power** is a measure of the energy available in the wind.

**Wind direction** at a site is important to understand, but it is not critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

South Africa can be considered as having a moderate wind resource as compared to Northern Europe (Scandinavia), Great Britain and Ireland, New Zealand and Tasmania. 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 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.

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) or 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.

The placement of a wind energy facility and the actual individual turbines must, therefore, consider technical factors such as the 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) and the effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Typically wind turbines need to be spaced approximately 2 to 3xD apart, and 5 to 10xD where a turbine is behind another (where 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 approximately 180 m to 300 m. The erection of turbines in parallel rows one behind another would require a distance between rows of 500 m to 700 m to avoid wake effects from one turbine onto another. Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria), the micro-siting of the turbines on the site will be determined using industry standard software systems, which will automatically consider the spacing requirements.

## 2.4. Wind turbines

Wind turbines, like windmills, are mounted on a tower to capture the most energy. 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.

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 near Molteno will have a hub height of up to 90 m, and a rotor diameter of between 88 m and 100 m (i.e. each blade up to ~50 m in length). The turbines being considered by Dorper Wind Farm would have a generating capacity of between 2 MW and 3 MW (in optimal wind conditions). Typically, 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 wind energy facility proposed would accommodate up to 244 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 132 $km^2$.

Other infrastructure associated with the facility includes internal service roads, access roads, power lines and up to four 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. The lifespan of the facility is approximated at 20 to 30 years.

### *2.4.1. Main Components of a Wind Turbine*

The 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.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of **lift** (Bernoulli). 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.

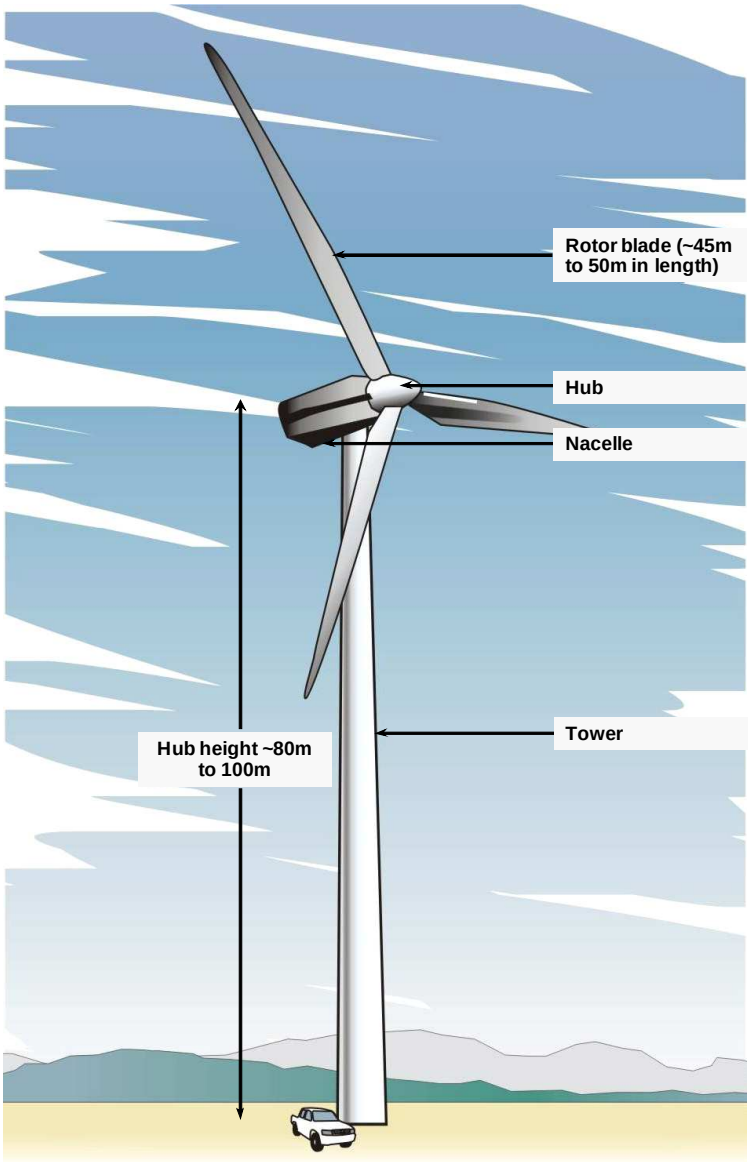



**Figure 2.5:** Illustration of the main components of a wind turbine.

**The nacelle**

The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction. The generator is what 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 tower**

The tower, which supports the rotor, is constructed from tubular steel. The tower will be between up to 90 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.

### *2.4.2. 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.

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 approximately 59%. 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.**

## 2.5. Project Construction Phase

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.

Information provided by the developer indicated that the 244 turbines will be erected in 3 phases. The first phase will involve the establishment of 100MW of generating capacity, or approximately 60 turbines. The second phase will involve the establishment of an additional 200MW (+-120 turbines). The third phase will involve the establishment of the final 100MW of generating capacity (+-60 turbines).

The following construction activities have been considered to form part of the project scope:

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

These are discussed in further detail below.

### *2.5.1. Conduct Surveys*

Prior to initiating construction, a number of surveys will be required including, but not limited to, geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, survey of substation site/s and survey of power line servitudes.

### *2.5.2. Establishment of Access Roads to the Site*

The R397 runs southeast – northwest through the site, and the R56 road runs through the northern sections of the proposed site. 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 R397. 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.

Access roads would also be left in situ after construction, however their width would be reduced to approximately 3 m after construction is completed, and the remainder of the access road would be rehabilitated.

### *2.5.3. Undertake Site Preparation*

Site preparation activities will include clearance of vegetation at the footprint of each turbine, the establishment of internal access roads and excavations for foundations. These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.

### *2.5.4. 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. 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.

A portable concrete batch plant would possibly be required to supply concrete onsite. The site would include an in-ground water recycling/first flush pit to prevent dirty water escaping onto the site, and would be fully remediated after the construction phase. As an alternative, concrete could be brought to site as ready-mix.

The tower would be seated in a reinforced concrete footing and would require removal of rock and subsoil at the base of each turbine. Various designs of footing are under consideration, based around a gravity footing (where subsoil geology is less stable) and a rock-bolted footing (where subsoil geology provides good bedrock). A combination of these footing designs may be used on the site depending on the geology at each turbine location.

Sands and aggregate would be sourced from turbine foundation excavations, where possible, or from existing approved sand and gravel pits within the region.

### *2.5.5. Transport of Components and Equipment to Site*

The wind turbine, including the tower, will be brought on site by the 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)[1] 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 are required on site to erect the wind turbines and need to be transported to site. In addition to the specialised lifting equipment/cranes, 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 substations (including transformers) as well as the power lines (including towers and cabling) will also be transported to site as required.

It is also necessary to have a delivery laydown area for the various components adjacent to the laydown areas. In most cases it is expected that the access road could be used as this delivery area.

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.

The equipment will be transported to the site using appropriate National and Provincial roads, and the dedicated access/haul road to the site itself.

### *2.5.6. 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. Laydown and storage areas will be

[1] A permit will be required for the transportation of these loads on public roads.

required to be established for the normal civil engineering construction equipment which will be required on site.

A hardstand area, typically 25 m x 50 m at the base of each tower, will be required at each position where the main lifting crane may be required to be assembled for tower erection. This area would be required to be compacted and levelled to accommodate the assembly crane.

A single, larger temporary laydown area of approximately 80 x 100 $m^2$ will also be required for temporary storage during construction.

An area for interim construction facilities (including the temporary concrete batching plant, civil and electrical storage, site offices and parking of approximately 5 000 $m^2$ would be required during construction of the facility.

### *2.5.7. Construct Turbine*

A large lifting crane will be brought on site. It will lift the tower sections into place, and lift the nacelle into position onto the top of the assembled tower. The rotor (i.e. the blades of the turbine) is typically assembled on the ground, and 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.

### *2.5.8. Construct Substations*

Up to four substations will be constructed within the site footprint. The turbines will be connected to the substations via underground cabling. The position of the substations will be informed by the final micro-siting/positioning of the wind turbines. The layout of the turbines has determined the optimum position for the construction of the substations (Figure 2.1). The largest of the four substations will be constructed with a high-voltage (HV) yard footprint of up to 250 m x 150 m.

The construction of the substations would require a survey of the sites; site clearing and levelling and construction of an access road to substation sites (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.

### *2.5.9. Establishment of Ancillary Infrastructure*

A workshop as well as a contractor's equipment camp may also be required to be constructed. The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

### *2.5.10. Connection of Wind Turbines to the Substations*

Each wind turbine will be connected to one of the four proposed substations by underground electrical cables (33 kV). 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.

### *2.5.11. Connect Substations to Power Grid*

New 132 kV distribution power lines are proposed to connect the individual substations within the facility to the Main on-site substation, which will connect directly into the existing Eskom 400 kV Beta-Delphi transmission line traversing the site (refer to Figure 2.1). Routes for the power lines will be assessed, surveyed and pegged prior to construction. These new power lines are all restricted to the site development 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.

### *2.5.12. 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. Hardstand areas would be left in situ after construction to provide for on-going maintenance and repairs if necessary. Access tracks would also be left in situ, however their width would be reduced to approximately 3 m after construction is completed.

## 2.6. Project Operation Phase

It is not known at this stage exactly how many people will be responsible for monitoring and maintenance of the facility. 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.

## 2.7. Project Decommissioning Phase

The turbine infrastructure which will be utilised for the proposed Dorper Wind Energy facility near is 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.

The following decommissioning activities have been considered to form part of the project scope.

### *2.7.1. 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.

### *2.7.2. Disassemble and Replace Existing Turbine*

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.

## 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.

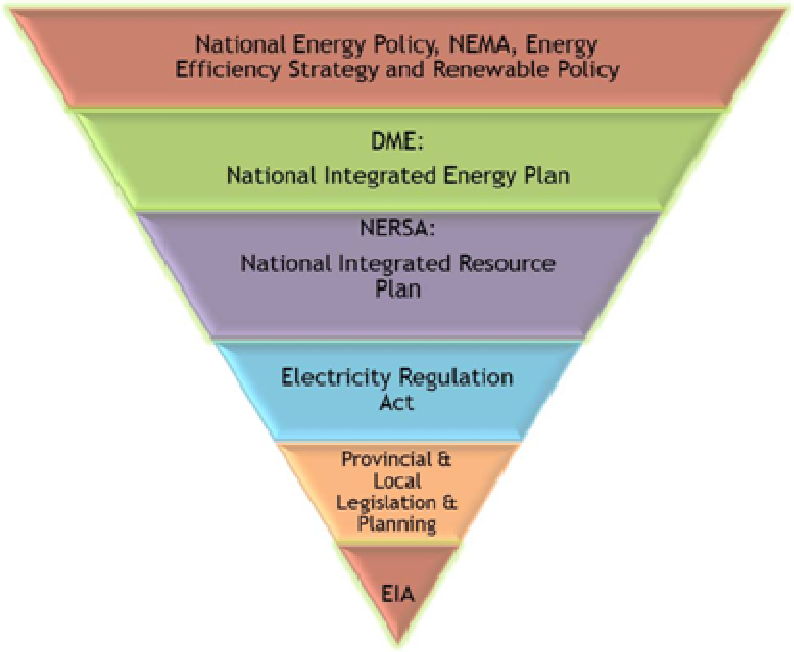



**Figure 3.1:** Hierarchy of electricity policy and planning documents

### *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 (http://www.energy.gov.za/files/irp_frame.html).

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 (http://www.doe-irp.co.za/). The Department of Energy is currently revisiting and revising the IRP, with the IRP2010 expected to be published by end-October 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:

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| *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 DEADEA 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 *Inkwanca Local Municipality*, which forms part of the greater *Chris Hani 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 Final 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 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.<br>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.<br>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.<br>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.<br>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** |

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| Environment Conservation Act (Act No 73 of 1989) | S20(1) provides that where an operation accumulates, treats, stores or disposes of waste on site for a continuous period, it must apply for a permit to be classified as a suitable waste disposal facility. | National Department of Environmental Affairs<br>Department of Water Affairs. | As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. |
| Environment Conservation Act (Act No 73 of 1989) | National Noise Control Regulations (GN R154 dated 10 January 1992). | National Department of Environmental Affairs<br>EC DEDEA - commenting authority.<br>Local authorities<br>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 |

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| | | | be applied for or obtained. |
| National Water Act (Act No 36 of 1998) | In terms of S19, the project proponent must 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. | Department of Water Affairs (as regulator of NWA) | 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. |
| 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.<br>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).<br><br>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"<br><br>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.<br>The Act provides that an air quality officer may require any person to submit an atmospheric impact report |

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| | | | if there is reasonable suspicion that 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<br>» the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;<br>» any development or other activity which will change the character of a site exceeding 5 000 $m^2$ in extent.<br>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.<br>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.<br><br>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. |

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| | 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.<br>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.<br>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).<br>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. Weeds are described as Category 1 plants, | Department of Agriculture | While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and |

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| | 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. | | 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.<br>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.<br>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.<br>Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified.<br>Overhead wires, cables etc., crossing a river, | 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. |

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| | 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.<br>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.<br>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;<br>Group IV: any electronic product;<br>Group V: any radioactive material. | 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. |

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| | 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.<br>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.<br>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 National Road Traffic Act and the relevant Regulations. | Provincial Department of Transport (provincial roads)<br>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:<br>» Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.<br>» Transport vehicles exceeding the dimensional limitations (length) of 22m.<br>» Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width). |
| Development Facilitation | Provides for the overall framework and | Local Municipality, District | The applicant must submit a land |

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| Act (Act No 67 of 1995) | administrative structures for planning throughout the Republic.<br><br>Sections 2- 4 provide general principles for land development and conflict resolution. | Municipality | 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.<br>Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project. |
| National Environmental Management: Waste Act (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.<br>» The Minister may amend the list by—<br>*(a)* adding other waste management activities to the list;<br>*(b)* removing waste management activities from the list; or 55<br>*(c)* making other changes to the particulars on the list. | National Department of Environmental Affairs (DEA) | The volumes of waste generated during construction and operation of the facility will not be large enough to require a waste license. |
| 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<br>» Interested and affected parties have right | National Department of Environmental Affairs (DEA) | No permitting or licensing requirements. |

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| | to be heard | | |

# 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 Dorper Wind Energy Facility near Molteno 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 concluded in May 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 Dorper 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 1 May 2010 to 30 May 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) on 3 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 in line with the Plan of Study for EIA as stated in the Scoping Report.

## 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 proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed Dorper Wind Energy Facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» 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
- Chris Hani District Municipality
- Inkwanca 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: EIA Phase*

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). Adjacent landowners were identified and informed of the project (refer to landowner map in Appendix C). 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 on-going 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: Barkley East Reporter and Midlands News newspapers)
» Written, faxed or e-mail correspondence

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.

| Area of Expertise | Specialist | Refer Appendix |
|---|---|---|
| Ecology: flora, fauna and wetlands | David Hoare of David Hoare Consulting cc | Appendix G |
| Avifauna | Andrew Jenkins of Avisense Consulting cc | Appendix H |
| Geology and erosion potential | Iain Paton of Outeniqua Geotechnical Services cc | Appendix I |
| Visual | Lourens du Plessis of MetroGIS | Appendix J |
| Heritage | Celeste Booth of the Albany Museum | Appendix K |
| Palaeontology | John Almond of Natura Viva cc | Appendix L |
| Noise | Morne de Jager of MENCO (M2 Environmental Connections cc) | Appendix M |
| Social Impact | Tony Barbour (Environmental Consultant and Researcher) | Appendix N |
| Public involvement process | Shawn Johnston of Sustainable Futures | - |

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 Dorper Wind Farm 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 Dorper Wind Farm 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 Dorper Wind Farm 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 and Feedback Meeting*

This Draft EIA report has been made available for public review from **17 September 2010 to 16 October 2010** at the following locations:

» www.savannahSA.com
» Molteno Library
» Sterkstroom Library

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Barkley East Reporter and Midlands News newspapers (refer to Appendix D).

In order to facilitate comments on the draft EIA report and provide feedback of the findings of the studies undertaken and receive comments to address in the draft EIA report, a public feedback meeting was held during the review period of the Draft EIA

Report. All interested and affected parties were invited to attend the **public feedback meeting** (held on: **16 August 2010** at the **Molteno Farmers Union Building** from **18:00 to 20:00**).

### *4.3.8. Final Environmental Impact Assessment (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 make a decision regarding the proposed project. This is the current phase of the project.

# DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 5

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Dorper Wind Energy Facility near Molteno 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, 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 EIA reports contained within Appendices G - N.

## 5.1 Location of the Study Area

The study area for the proposed wind energy facility is situated in the Inkwanca Local Municipality of the Eastern Cape (Figure 5.1.). The proposed project site is located 11 km from the town of Sterkstroom (lies to the south-east), and 1.8 km from the town of Molteno (lies to the northwest). The study area straddles the R56 road that links Molteno to Dordrecht and the R397 that links Molteno to Sterkstroom and eventually the N6. The site is therefore well-connected to an important regional route in this region.

In terms of its specific location of the proposed project, the demarcated study site includes portions of the following farms: Spreeukloof (portion 18), Paarde Kraal (portion 7), Uitekyk (portions 1, 3 and remaining extent), Farm 68 (portion 4), Cypher Gat (portions 1, 2, 3, 4, 5, 6, 7, and 9 and remaining extent), Highlands (remaining extent), Tolkop (portions 1 and 4), Bushmans Hoek (remaining extent) and Post Houers Hoek (remaining extent).

The site is traversed by the Eskom transmission power line (Beta-Delphi 1 400kV line) and an Eskom distribution power line (Carrickmore-Putterskraal 1 132kV line). The R397 roads run from north-west to south-east through the study site. There is also a railway line that runs parallel to the main road for parts of its length.

The Inkwanca Local Municipality (Figure 5.1), which forms part of the greater Chris Hani District Municipality (DC13, category-C municipality), is located in the central Eastern Cape approximately 269km north-west of the Buffalo City Municipality (East London) and 84 km north-west of Queenstown. The municipality area is approximately 3 584 km² in size (~9.7% of the Chris Hani District Municipality) and bordered in the in the north by the Gariep Local Municipalities (part of the Ukhahlamba District Municipality), in the east by the Maletswai (Ukhahlamba District Municipality) and Emalahleni Local Municipalities,

in the south by the Lukanji Local Municipality and in the west by the Tsolwana Local Municipality.

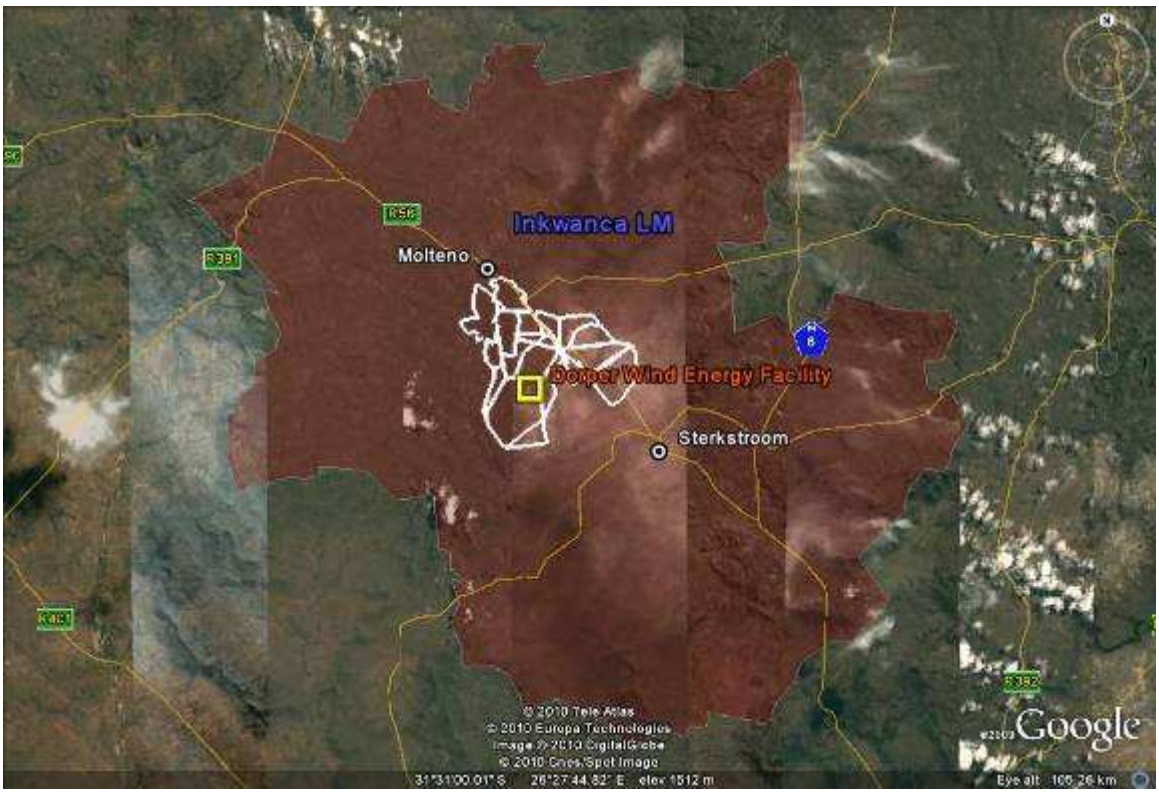



**Figure 5.1:** Inkwanca Local Municipality area

Due to its relatively small population, the municipality has no administrative wards.

## 5.2 Climatic Conditions

The study area is within a summer rainfall region, but bordering on a part of the Eastern Cape that experiences bimodal (Autumn and Spring) maximum rainfall. The mean annual rainfall in the study area is approximately 600 mm along the escarpment edge, but drops to 430 mm at Molteno (Dent *et al*. 1989). In grasslands, all areas with less than 400 mm are considered to be arid grasslands. The parts of the study area along the escarpment can therefore be considered to be relatively mesic and, from a floristic point of view, to represent the Grassland Biome within the Eastern Cape. However, the areas close to Molteno can be considered to be relatively dry and, from a floristic point of view, to represent the boundary between grassland and karroid vegetation types.

The mean temperatures of the mountainous regions are generally lower than the plains to the south of the escarpment (Kopke, 1988). Frost is a common phenomenon and the coldest periods (usually from June to August) are exacerbated by seasonal aridity. Winter frost is common and especially severe at higher altitudes. Buffelsfontein (to the east of the study area) is a weather station that has recorded the coldest temperatures

in South Africa. The average daily minima for the coldest months are below freezing. Winter frost and cold is therefore a potentially limiting factor for plant growth.

Average daily maximum and minimum temperatures range from 27.1°C and 11.6°C to 13.3°C and -2.3°C for January and July respectively, although the lower areas towards Sterkstroom are around 2-3°C warmer on average.

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

The proposed development site spans the Bamboesberg Mountain, which forms part of the Mountains of the Great Escarpment of South Africa. The predominant topographical unit or terrain type to the north of the study area, located on the plateau, is described as lowlands with hills and low mountains. Lowlands and predominantly plains are found to the south of the study area and irregular undulating lowlands with hills to the east.

No major perennial rivers occur within the study area. The major non-perennial rivers include the Hex River (traversing through Sterkstroom), the Klaas Smits River and the Buffelsspruit River below the escarpment and the Stormbergspruit River (flowing into the Molteno Dam) and Spioenkopspruit located on the plateau. The largest water body within the study is Die Pan (The Pan) also located on the plateau.

## 5.4 Social Characteristics of the Study Area

### *5.4.1 Demographic Profile*

The population the Inkwanca Local Municipality is estimated at 2047 (Inkwanca IDP 2009-2010) and makes up only 2.4% of the total population of the greater Chris Hani District Municipality. The main towns of Molteno and Sterkstroom account for approximately 16 839 (83.2%) of this total. Given the size of the Municipality and the relatively small total population size, the average population density within the Municipality is very low.

The majority of the population is Black African (89%) with the remaining percentage made up by the White (6.53%) and Coloured (4.25%) population groups. The dominant language within the Municipality is isiXhosa (89%) with the remainder made up of Afrikaans (8.1%), English (1.9%) other African languages (0.45%).

Broadly, the level of education within the Municipality is low with approximately 29% (>1 in 4) of the population having no formal education, while approximately 64% have less than a Standard 5. Approximately 9% of the school going age population have a matric qualification, while just over 5% has a tertiary qualification.

### *5.4.2 Economic Profile*

Economically, the Inkwanca Local Municipality contributes approximately 9.7% of the greater Chris Hani District Municipality's GGP. The most important sector in terms of contribution to GGP is the Agricultural sector (39%). This sector is followed by the Community and Social Services sector that employs ~18% of the employed population and the Private Households sector, providing 15% of the employment in the Municipality. The other significant formal employment sectors are the Construction (5.3%) and Manufacturing sectors (4.4%).

Employment data for Inkwanca Local Municipality indicates that only 25% of the population between 15 and 65 are employed in the formal sector and the unemployment rate is ~27%. This falls below the Eastern Cape average of ~32%.

Based on the data from the Inkwanca IDP (2009-2010), 66% of the population have no formal income and an overwhelming 93% earn less than R 800 per month (the official breadline figure).

The findings of a review of the relevant policy documents pertaining to the energy sector indicate that wind energy and the establishment of wind energy facilities are supported at national, provincial and local levels.

## 5.5. Biophysical Characteristics of the Study Area

### *5.5.1 Geography and Terrain*

A general view of the topography of the study area is illustrated in Figure 5.2. The study site is located on southern escarpment of the Stormberg Plateau. The Bamboesberg Mountains run in a north-east to south-west direction in this area and form part of the Great Escarpment. The Stormberg Plateau is not flat, with various high-lying areas situated within the plateau, including the Lopersberg and Spioenkop, which are found along the north-eastern boundary of the site. The central part of the site is relatively flat compared to the surrounding mountainous terrain.

The Bamboesberg peaks at 1983 m above sea level in the southern part of the study area, Malabarsberg peaks at 2106 m above sea level in the south west, and Spioenkop peaks at 2007 m above sea level on the north-eastern boundary of the study area. The base of these mountains are at approximately 1700 m, which marks the flatter part of the study area on the plateau. This contains various local topographic variations where it drops into stream valleys and drainage lines. The lowest elevation in the study area is in the north close to Molteno, where the drainage lines exit the site via the dam just south of Molteno. This is at an elevation of 1590 m, which indicates that the plateau portion of the study area varies in elevation by a maximum of 100 m.

The proposed development site spans the Bamboesberg Mountain, which forms part of the Mountains of the Great Escarpment of South Africa. The predominant topographical unit or terrain type to the north of the study area, located on the plateau, is described as lowlands with hills and low mountains. Lowlands and predominantly plains are found to the south of the study area and irregular undulating lowlands with hills to the east.

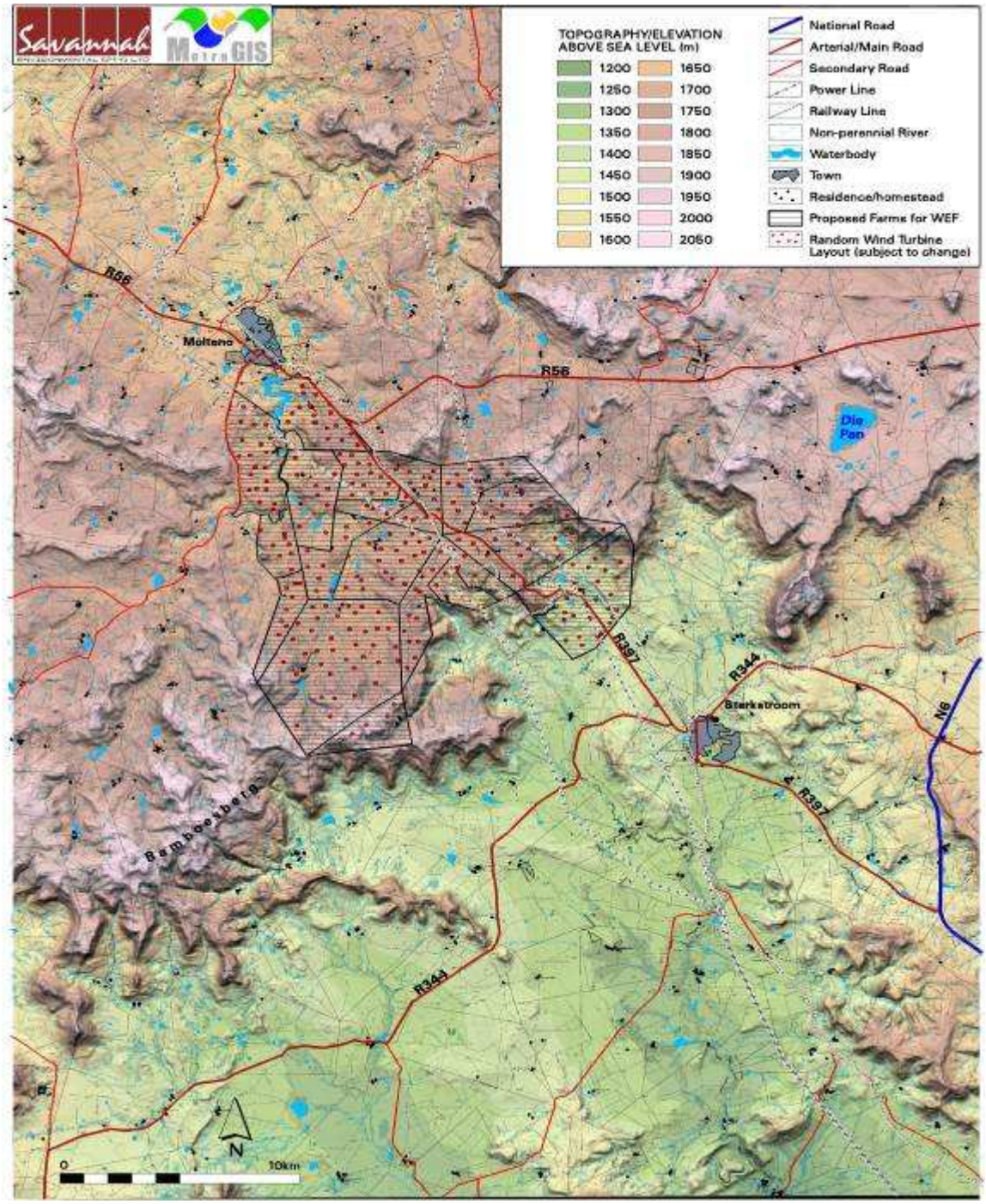



**Figure 5.2.** Shaded relief map (indicating topography and elevation above sea level) of the broader study area

### *5.5.2 Land Use*

Sheep farming dominates the general land-use character with very little crop cultivation due to the relatively low rainfall (300-500 mm per annum), absence of perennial rivers and the mountainous terrain (refer to figure 5.3). The predominant natural vegetation type is described as mountain grassland and shrubland along the steep slopes of the Bamboesberg.

The region has a population density of less than ten people per km$^2$, concentrated primarily within the small towns of Molteno and Sterkstroom. A great number farm settlements or homesteads occur throughout the study area.

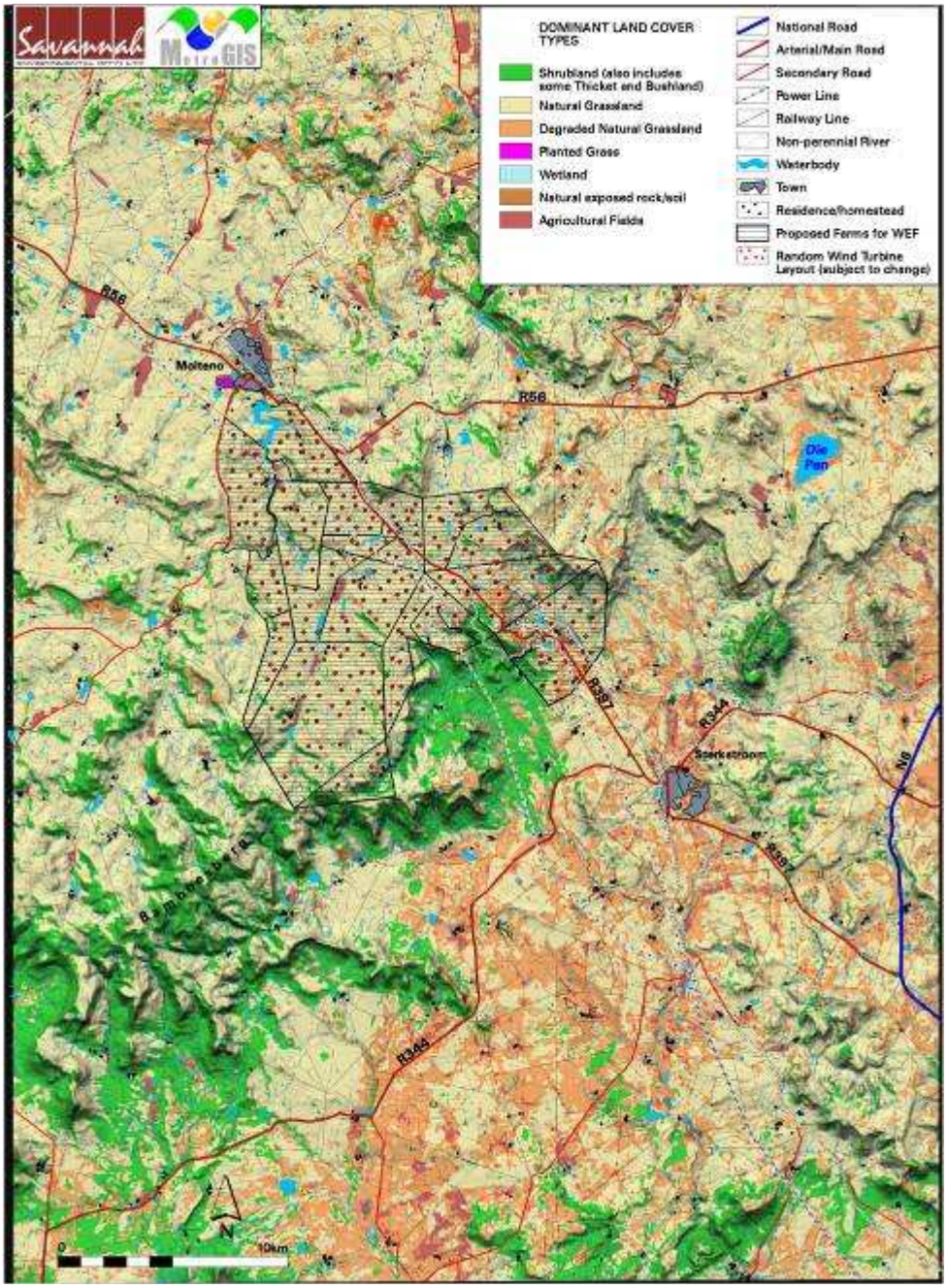



**Figure 5.3.** Land cover/land use map of the broader study area

### *5.5.3 Geology and Soil*

The 1:250 000 Geological map of the area (3126 Queenstown) published by the Council for Geoscience indicates that the study area is dominantly underlain by sedimentary rocks of the Molteno Formation. Sporadic overlying Elliot Formation is mapped in the

southern and north eastern portions of the study area and minor underlying Burgersdorp Formation (Beaufort Group) is mapped in the western and southern edges of the study area. The Molteno Formation consists of gritstone, sandstone, mudstone, shale and coal seams, the Elliot Formation comprising mainly mudstone and subordinate sandstone, and the Burgersdorp Formation comprising mudstone and sandstone. All sedimentary formations are late Triassic age and have been intruded by transgressive dolerite sills of Jurassic age, which underlies a significant area in the northern portion of the study area. Numerous dolerite dykes are also mapped within the study area. Several coal deposits within the Molteno Formation have been mined in the northern, eastern and southern portions of the study area. The status of these mines is unknown at this stage.

Soils types are controlled by the parent rock type, topography and climate of the area. The varied lithology (rock types) in this study area produces a wide variety of soils, ranging from gravels to clays. In this case, topography and moisture regime have more control on the development of the soil type. Erosion is the dominant process on steep slopes and deposition is the dominant process on flatter areas and this has a great effect on the thickness and texture of soils. Soils on steep to moderate slopes are generally restricted to thin, coarse-grained transported soils (talus gravel deposits). On lower slopes, the deposition of thicker, finer accumulations of transported soil is common and this also aides the formation of residual soils, which are formed by the chemical weathering of the parent rock. The climate of the area and the soil moisture regime is also important in the development of residual soils and one can expect very fine-grained sandy clays and clayey silty sands produced from the chemical weathering of dolerite, sandstone and mudstone on flatter slopes. The topography of the study area suggests that the dominant surficial soils are likely to be transported silty sands and gravels, which may be underlain by residual clayey soils. Rock outcrops are common in the study area (40% of the study area). Thick accumulations of Quaternary alluvium (gravels, sand and silt) have been mapped in the lower southwestern areas on Bushmanshoek Farm, associated with ephemeral tributaries of the Hexrivier (5% of the study area).

### *5.5.4 Ecological Profile*

The study area falls within the Grassland Biome (Rutherford & Westfall 1986). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina et al. 2006). This map shows six vegetation types occurring in the study area, Karoo Escarpment Grassland, Aliwal North Dry Grassland, Stormberg Plateau Grassland, Southern Drakensberg Highland Grassland, Tarkastad Montane Shrubland and Queenstown Thornveld (as illustrated in Figure 5.4).

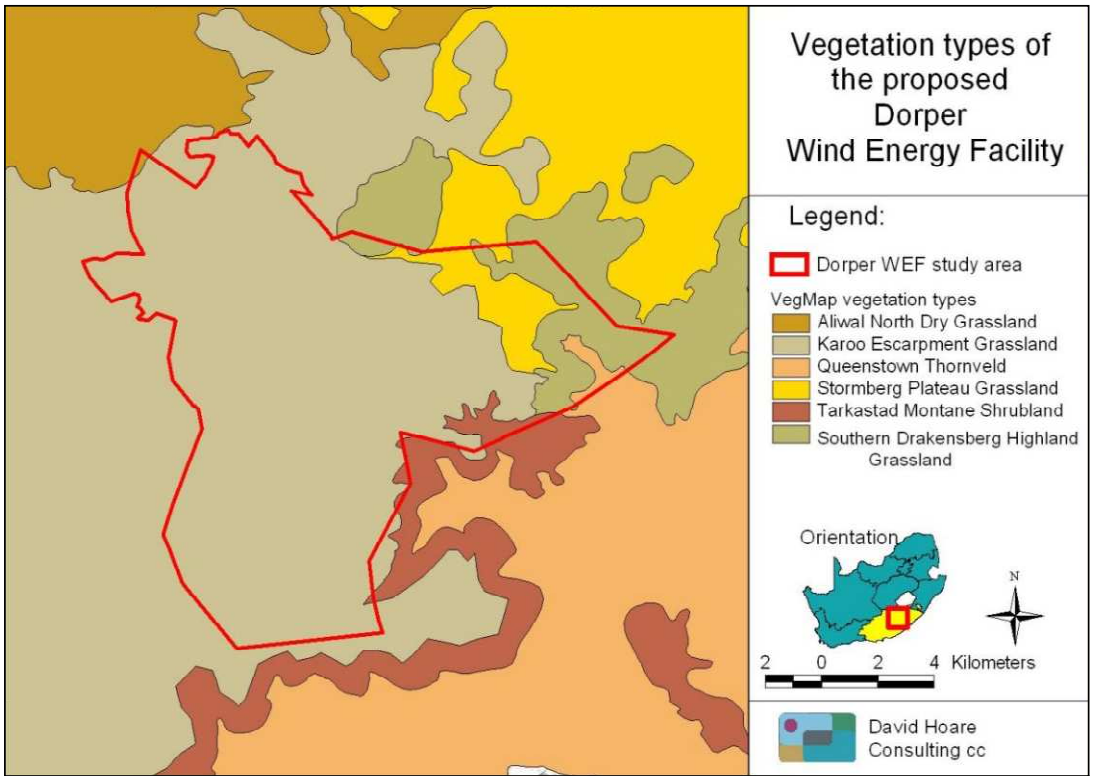



**Figure 5.4:** Vegetation types occurring on the project development site and surrounding areas

Of the three vegetation types occurring in the study area, all the vegetation types are classified as Least Threatened (Driver et al. 2005; Mucina et al., 2006).

The national landcover map (Fairbanks et al. 2000) indicates that the majority of the site consists of natural grassland, with small localised areas that have been cultivated. There is a small patch of low shrubland close to Molteno that indicates karroid vegetation types just entering the north of the site. A detailed assessment of landcover of the site, as mapped from aerial photography (Figure 5.5) indicates that large parts of the site are still natural.

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 scoping report (Appendix G). Of the species that are considered to occur within the geographical area under consideration, there were eleven 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.

All vertebrates of conservation concern (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 2 of the ecology scoping report (Appendix G). There are 17 mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Endangered (the white-tailed rat), nine species classified as near threatened, and nine species

classified as data deficient. Two of these species are bats (Schreiber's long-fingered bat and Darling's horseshoe bat), all of which are cave-dwelling aerial insectivores.

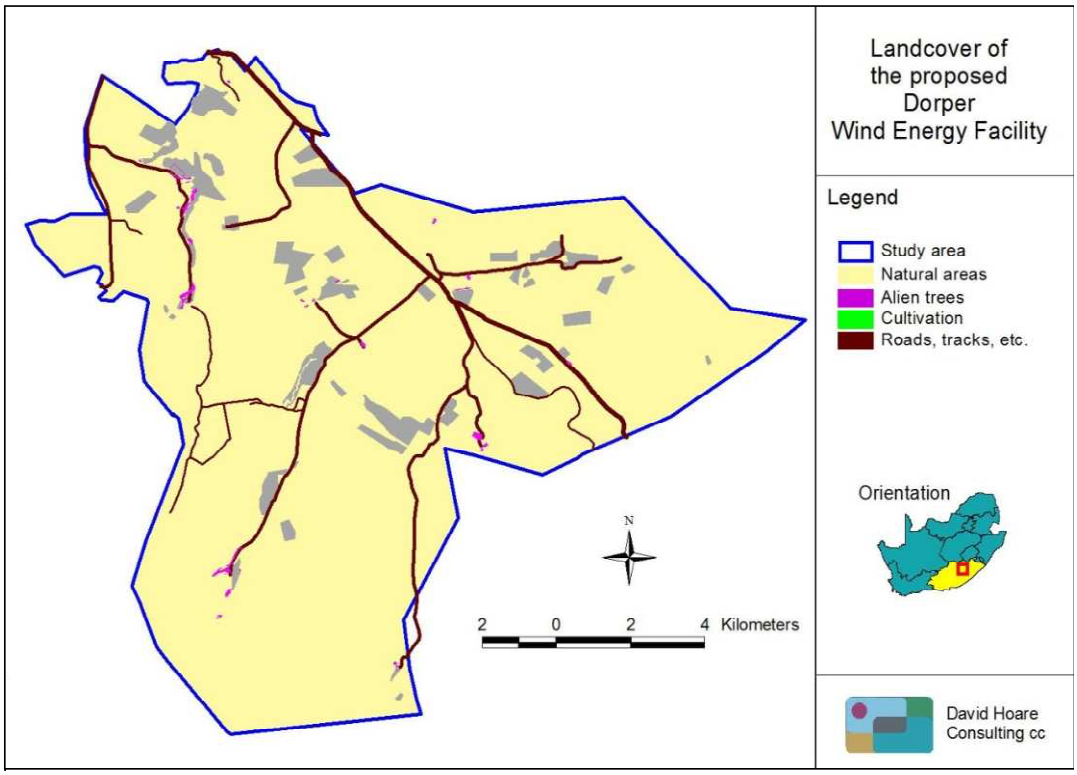



**Figure 5.5:** Detailed land cover map for the proposed Dorper Wind Energy Facility development site

Tree species protected under the National Forest Act are listed in Appendix 3 of the ecology scoping report (Appendix G). Those that have a geographical distribution that includes the study area are *Catha edulis, Pittosporum viridiflorum* and *Podocarpus latifolius*. There is no dense woodland or forest on site. There are some sparse patches of low woodland on the escarpment slopes and on other steep rocky areas within other parts of the study area. The only species that is likely to occur in such habitats is *Pittosporum viridiflorum* (cheesewood), but this species is unlikely to occur in sparse woodland as found on site. Examination of various low woodland areas in different parts of the site did not locate any individuals of this species. Unless there are proper forest patches, the other two mentioned species would also not occur on site. It is, therefore, considered unlikely that any of these species occur on the site.

The study area is not located close to any recognised national Important Bird Areas (Barnes 1998), but is likely to support a diverse avifauna, including some important populations of rare, threatened and/or endemic species. At least 289 bird species could occur with some regularity within the anticipated impact zone of the wind energy facility, including 60 endemic or near-endemic species, 21 red-listed species, and seven species – Ludwig's Bustard, Blue Korhaan, Blue Crane, Cape Vulture, Black Harrier, Bush

Blackcap and Melodius Lark– which are both endemic and red-listed (Barnes 1998, 2000, Table 1).

The birds of greatest potential relevance and importance in terms of the possible impacts of the proposed wind energy facility are likely to be (i) flocks of wetland species commuting between resource areas (especially in relation to the Molteno Dam), flocks or breeding pairs of Grey-crowned Crane and Blue Crane, seasonal influxes of Ludwig's and Denham's Bustard (Young *et a*l. 2003, Hockey *et al*. 2005), groups of Southern Ground Hornbill and a range of locally resident or visiting raptors (possibly including Cape Vulture, African Marsh Harrier, Black Harrier, Peregrine Falcon and Lanner Falcon) foraging or moving through the area, and a suite of restricted range endemic passerines, possibly including Melodius Lark (refer to Appendix 1 of avifaunal scoping report – Appendix H).

### *5.5.5 Critical biodiversity areas in the vicinity of the proposed development site*

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 & Desmet 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows (for the study area):

1. PA: Protected areas.
2. CBA 1: Critically endangered vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. 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.
4. CBA 3: Vulnerable vegetation types.

Within and around the study area, the ECBCP identifies CBAs at one level that occurs within the region in which the study area is located. A large proportion of the site occurs within an area classified as CBA 2 (Figure 5.5). These are corridor areas, which are important for a number of reasons, including the maintenance of ecological processes. These areas will be affected by the proposed facility, since they constitute many of the farm portions under assessment.

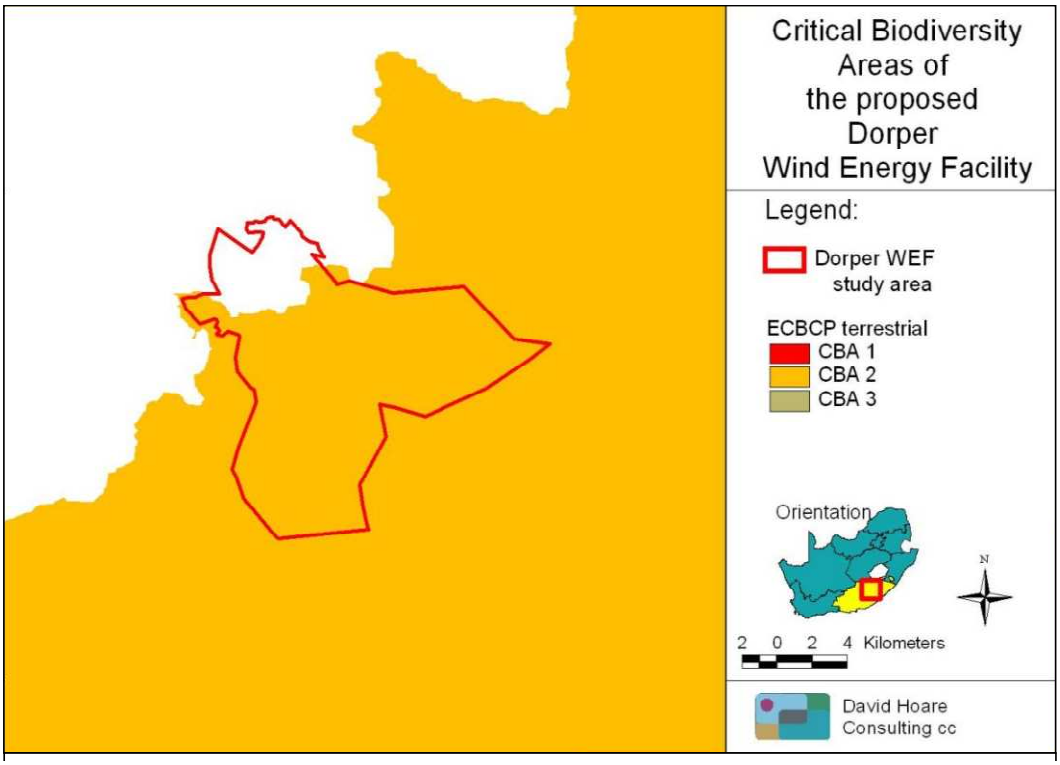



**Figure 5.5:** Important Biodiversity Areas occurring on the project development site and the broader study area

The study site occurs within the Albany Centre of Floristic Endemism. 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.

### *5.5.6 Agricultural Potential*

Much of the study area consists of either:

» Structured, clay soils (Swartland, Estcourt, Sterkspruit) of low to moderate potential;
» Shallow lithosols (Mispah, Glenrosa) of low potential; or
» Rock.

Very little of the area contains high potential soils. Several cultivated fields are present in the central portions of the area on the farms Cyphergat and Uitkyk, as well as small areas closer to Molteno. The grazing capacity of the area is low to moderate, around 12-15 ha/large stock unit (ARC-ISCW, 2004).

### *5.5.7 Heritage & Palaeontology Profile*

» *Pre-colonial heritage*

No systematic archaeological research has been undertaken in the study area. However, extrapolation from surveys done in similar environments in the Eastern Cape indicate a high likelihood that Middle Stone Age artefact scatters will occur in the study area. The majority of such sites have low heritage significance for their scientific value, since they are rarely associated with organic remains and contribute little to knowledge of that time period. If rock paintings are present, they could have medium to high heritage significance for their aesthetic and scientific values.

» *Colonial heritage*

The history of the greater study area is one of European settlement since at least the mid-nineteenth century. Accordingly, scattered farmsteads (with or without family cemeteries) along with the agricultural infrastructure associated with extensive stock farming are anticipated on the site.

» *Palaeontology*

The wind energy facility site is underlain by several units of potentially fossiliferous continental sediments in the upper, Mesozoic part of the Karoo Supergroup. These Karoo rocks are extensively intruded by unfossiliferous dolerites of the Early Jurassic Karoo Dolerite Suite. The rocks consists of flat lying to shallow dipping sedimentary rocks of the (oldest to youngest) Beaufort Group and Molteno, Elliot and Clarens Formations overlain by locally distributed volcanic rocks of the Drakensburg Group. Many rock units of the Karoo Supergroup are richly fossiliferous and offer a continuous record of reptile and early mammal development between the period 300 and 180 million years ago. Among the Mesozoic units small, peripheral exposures of the Burgersdorp and Elliot Formations are unlikely to be directly affected by the proposed development. Late Caenozoic alluvial sediments in the eastern portion of the study area are of low palaeontological sensitivity.

In contrast, the Late Triassic Molteno Formation that underlies the greater part of the study area is internationally famous for its remarkably rich assemblages of plant and insect fossils. These include the richest Triassic (c. 220 million year old) fossil floras recorded anywhere in the world, as well as some of the oldest known dinosaur trackways. Several key fossil sites are already recorded within the Molteno Formation in the Molteno – Sterkstroom outcrop area.

South Africa is internationally famous for the discovery of a group of unique and important mammal-like reptiles (Therapsids) in the Beaufort Group, which represent the transitional development between reptiles and mammals. Extensive research has been published based on studies of the various fossil sites containing Therapsid remains and

many of these are regarded as important heritage sites of international importance (Modesto *et al,* 2001).

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

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed facility is referred to as the Dorper Wind Energy Facility. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd.

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 132 $km^2$ 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 185 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 244 **wind turbine** units (up to 90 m high steel tower and nacelle; up to 100 m diameter rotor - consisting of 3x50m blades);
» **Concrete foundations** (approximately 20m x 20m x 2m) to support the turbine towers;
» Underground electrical distribution cabling between the turbines;
» Up to four **substations** (the largest being up to 150 x 250 m) on the site in an appropriate position to receive generated power via underground distribution cabling from each wind turbine;
» **Power lines** (132 kV distribution lines) linking the 4 substations directly into the existing Eskom transmission lines traversing the site;
» An **access road** to the site from the main road/s within the area;
» **Internal access roads** to each wind turbine to link the turbines on site (approximately 3-6 m in width); and
» A **workshop area** for storage and maintenance.

Several 132 kV distribution power lines are proposed to connect the four substations in the facility to the existing transmission line which traverses the site (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.

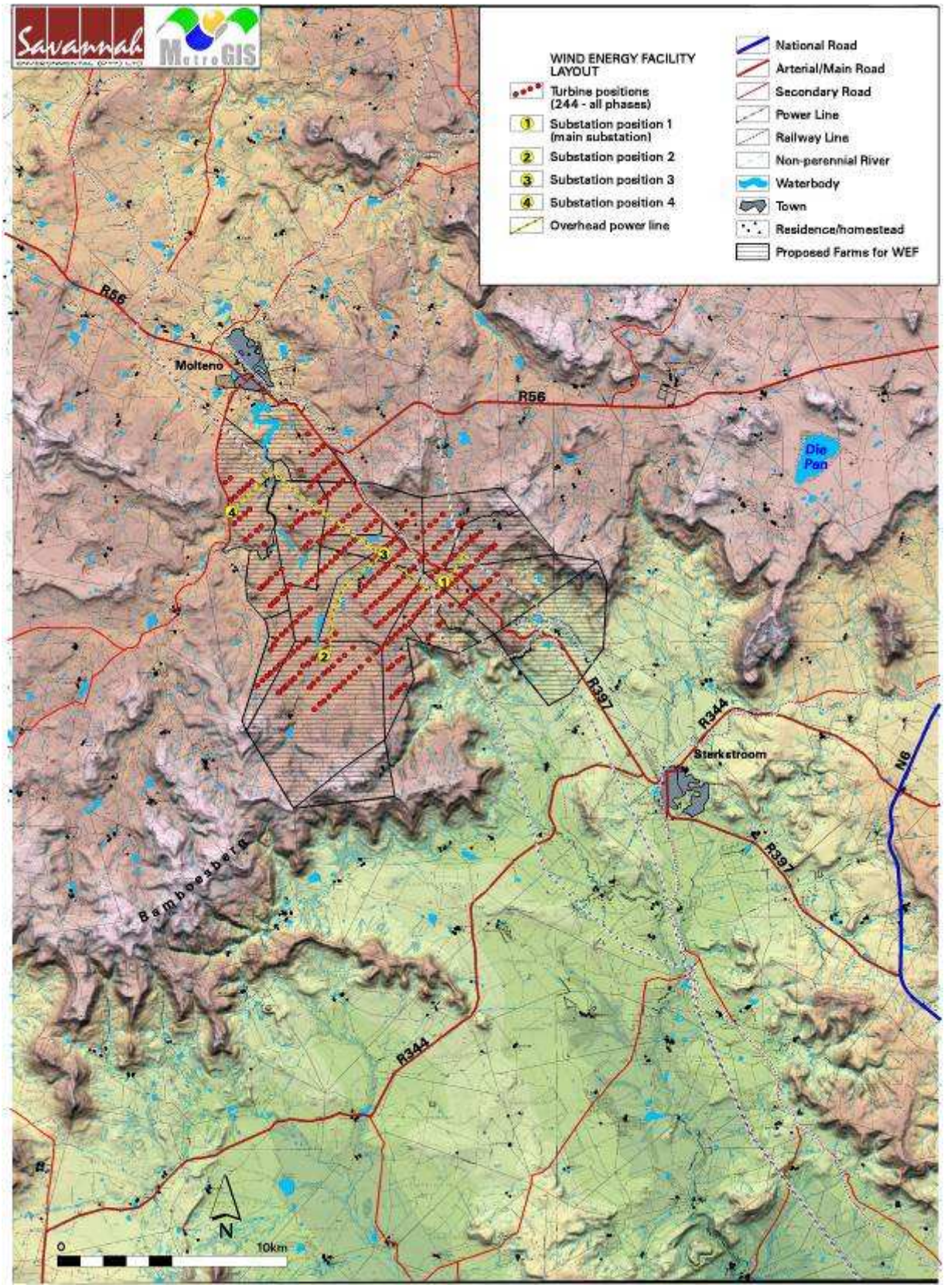



**Figure 6.1:** Locality map showing provisional wind turbine layout, power line corridors and substation sites

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, substation and other infrastructure from a technical perspective. For those specialists who were required to consider each turbine position as a separate/discrete "unit", the turbine positions provided were used as being 90% accurate.

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, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. A map of sensitive areas is shown in Figure 6.2. This indicates that the escarpment zone and wetlands have high sensitivity, all other natural areas have medium sensitivity, and transformed and degraded areas have low sensitivity. The mountain and escarpment zone is considered to have high ecological value due to the ecological processes operating there. Steep slopes can be problematic in constructing infrastructure due to the fact that any impact can have an effect downslope from that point. Depending on the steepness and the length of the slope, particular areas may be more sensitive to disturbance than others. Any steep slopes are, therefore, considered to have elevated sensitivity in this assessment.

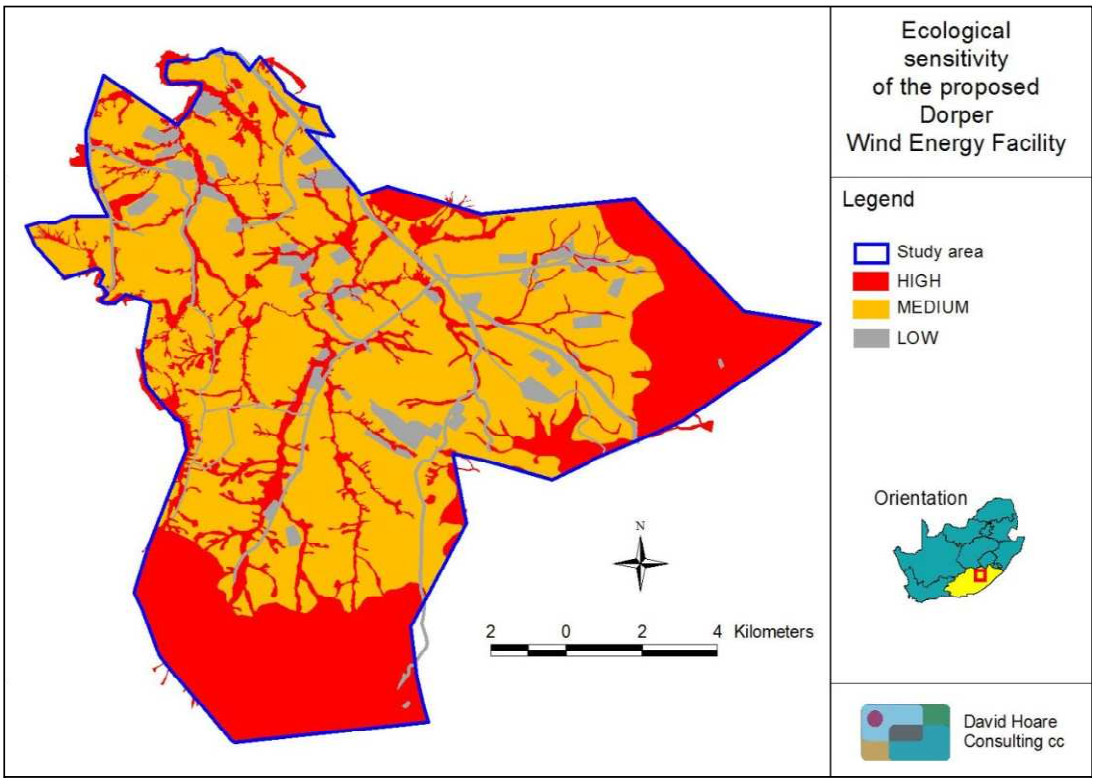



**Figure 6.2:** Map indicating the sensitive ecological areas in the study area

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 farm 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. 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.

» **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.

There is one threatened species, the White-tailed Rat and two near threatened bats (Schreiber's long-fingered bat and Darling's horseshoe bat) that could potentially occur on site.

» **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. No species of high conservation concern are likely to occur on site. This potential impact is therefore not considered further.

» **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 desktop and field evaluation indicated that no protected trees occur on site or are likely to occur on site. This potential impact is therefore not considered further.

» **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.

» **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.

» **Increased risk of veld fires**

During construction there is a higher risk of veld fires around construction sites due to the use of fires for cooking and warmth by construction workers. Fire regimes may also change at the operational phase due to the use of fire as a management tool for controlling vegetation growth. Impacts that may arise from this may include:

- damage to sensitive habitats, especially damage to woodland vegetation and change in species composition in grasslands;
- damage to populations of sensitive plant species;
- loss of vegetation biomass; and
- increased soil erosion due to loss of vegetation cover.

***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 bat species***

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility, Schreiber's Long-fingered Bat and Darling's Horseshoe Bat. The species are classified as near threatened, which is a category of lesser concern than any of the threatened categories (critically endangered, endangered or vulnerable). Both are cave-dwelling species and may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has been established that the landscape contains suitable roosting sites, but no colonies were found on site or are known from the general area. It is highly likely, given the rugged landscape in which the site is located and the distribution of the four species, that colonies of these species are located within the zone of influence of the wind energy facility.

A monitoring programme should be implemented to document the effect on bats. This should take place before construction (to provide a benchmark), during construction and during operation. During operation, consideration must be given to stopping operation at key times when bats are vulnerable. A study done recently showed a 73% drop in bat fatalities when wind energy facility operations were stopped during low wind conditions, when bats are most active. Bats are also known to avoid radar transmitters – it is suggested placing microwave transmitters on wind turbine towers may reduce the number of bat collisions.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Regional (3) | Regional (3) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | Medium (5) | Low (3) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Medium (36)** | **Medium (30)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Partially reversible | Partially reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | To some degree | |

***Mitigation:***

» Implement an environmental monitoring programme to document the impact on bat species.
» Consider stopping operation at key times when bats are vulnerable.

***Cumulative impacts:***

No other developments are likely to cause similar effects on bats

***Residual Impacts:***

Some impacts are likely to occur irrespective of control measures, but mortalities may be significantly reduced with proposed control measures.

***Nature: Impacts on individuals of threatened animal species***

There are fifteen mammal species of conservation concern, of which one is classified as Endangered and five as Near threatened, one near threatened frog species and two near threatened reptile species that could potentially be affected by the proposed wind energy facility. The endangered mammal species is the White-tailed Rat, which occurs throughout most of South Africa and was evaluated as having only a medium probability of occurring in the study area. Of the remaining species, only Sclater's Golden Mole is likely to be bound to a particular site, if it occurs there, due to the fact that it occurs within subterranean tunnels that it constructs. None were observed on site and it is therefore considered unlikely that the species occurs on site. For the remaining species (including the White-tailed Rat, individuals are likely to move away during construction and return to natural habitats during operation. On condition natural habitat is not affected to a significant degree, it is unlikely that construction of the wind energy facility will have a significant impact on any of these species

The impact will be local, likely to be an impact of low magnitude (in terms of the

individuals and habitats that will be affected) and of short-term duration (construction phase only). It is highly improbable that the impact will occur. The overall significance of the impact is therefore rated as low.

| | **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 (10)** | **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 natural areas (see below).

***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 indigenous natural vegetation***

Each wind turbine will require an area of a minimum of 20 x 20 m to be cleared. There will therefore be localised impacts associated with the construction of each wind turbine. The collective impact of 244 turbines is likely to lead to a loss of a minimum of approximately 10 ha of natural vegetation. It has been established that the most widespread vegetation type on site is Karoo Escarpment Grassland, which is classified as Least Threatened. A large proportion of the site has been classified in the ECBCP as having high conservation value, but the components of the site equivalent to the feature in question have been identified and are not affected by the proposed infrastructure.

The impact will therefore be local and possibly surrounding areas, of low to medium magnitude (in terms of the grassland that will be affected) and probably of permanent duration. It is definite that the impact will occur. The overall significance of the impact is therefore rated as medium.

If the project takes place then there will have to be some clearing of vegetation for each turbine. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbine and the approach/access road.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low medium (3) | Low medium (3) |

| | | |
|---|---|---|
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (45)** | **Medium (40)** |
| ***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.

***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 Wetlands***
There are a number of seasonal wetlands on site that could potentially be affected by the proposed construction of wind turbines. There are some turbines that are currently positioned within or immediately adjacent to mapped wetland areas (Figure 6.3).

The impact will be of medium magnitude and of permanent duration. According to the current position of the turbines, it is definite that the impact will occur. The overall significance of the impact is rated as low. There is also a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.

Stormwater and runoff water must be controlled and managed to avoid siltation and surface hydrological impacts on wetlands. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources. Infrastructure should be kept a minimum of 30 m away from the edge of the temporary zone of any wetland feature.

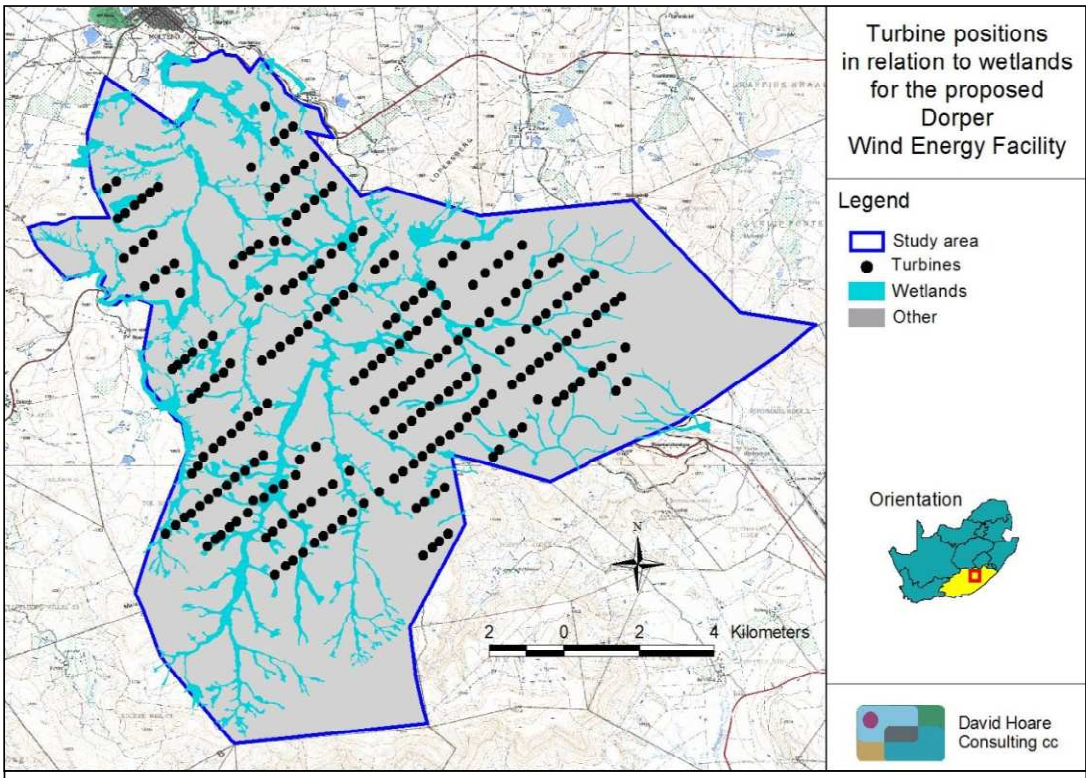



**Figure 6.3:** Turbine positions in relation to wetland/water resource features

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Medium (5) | Medium low (4) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (60)** | **Medium (55)** |
| ***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.

***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 leading to increased soil erosion and siltation of downslope areas***

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 wetlands potentially occurring on site, but turbine positions vary in terms of slope and substrate properties. In a number of cases there is sufficient slope to warrant concern with respects to this potential impact or the turbine is at the summit of a steep slope. However, the most sensitive parts of the site (in terms of steep slopes), the escarpment zone, do not have turbines located within them The potential impact is likely to be at a local scale, but may affect surrounding (downslope) areas. It is likely to be long-term and, in a worst-case scenario, may lead to impacts of moderate magnitude. There is some severe erosion in drainage lines in the study area that indicate that this impact could occur and it is therefore assessed as probable that this impact will occur in the absence of control measures.

A comprehensive stormwater management plan must be compiled that 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 gabiens, weirs, rock-packing, etc.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Long-term (4) | Medium-term (3) |
| ***Magnitude*** | Moderate (5) | Moderate to low (4) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (22)** | **Low (18)** |
| ***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.

***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 known to harbour alien trees in significant numbers in discrete areas. The main species of concern is *Acacia mearnsii*, which occurs adjacent to existing disturbance on site. There is therefore a strong potential for alien trees to spread following disturbance on site. The presence of a diffuse disturbance over a wide area could lead to the spread of a number of other species that are present in the area.

The potential impact is likely to be at a local scale and surroundings, but may have a more regional effect if aliens become firmly established on site. It is likely to be a long-term impact and, in a worst-case scenario, may lead to impacts of high magnitude. It is assessed as highly probable that this impact will occur in the absence of control measures.

The impact will occur at the site of the proposed facility, but could potentially spread extensively into the surrounding landscape. The impact will therefore be evaluated at a scale of site and surroundings or regional.

There is a high likelihood that alien species will spread on site in the absence of control measures. It is likely to be a long-term impact with potentially high magnitude of impact on local ecosystems. The impact could therefore potentially be of moderate to high significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance to low.

Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | regional (3) | regional (3) |
| ***Duration*** | long-term (4) | long-term (4) |
| ***Magnitude*** | moderate to high (7) | moderate to low (3) |
| ***Probability*** | highly probable (4) | improbable (2) |
| ***Significance*** | **medium (56)** | **low (20)** |
| ***Status (positive or negative)*** | negative | negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be*** | To some degree | |

| | | |
|---|---|---|
| ***mitigated?*** | | |

***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

***Nature: Increased risk of veld fires***

The site is within an area of grassland that is managed for livestock farming. It is also within an area that experiences naturally high natural fire frequencies. It is likely that the managers of the wind energy facility would include fire control measures to protect their infrastructure. It is therefore unlikely that increased fire frequencies would occur as a result of the operation of the infrastructure. It is possible that construction and operation activities will lead to accidental fires within natural vegetation. Although the vegetation is unlikely to suffer long-term ill-effects, personal damage to property may occur.

The potential impact is likely to be at a local scale, but may affect surrounding areas. Its likely to be short-term (construction) and long-term (operation). It may lead to impacts of low magnitude on natural systems. It is assessed as probable that this impact will occur in the absence of control measures.

Comprehensive fire and emergency procedures must be established for use during construction and operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | local and surroundings (2) | local and surroundings (2) |
| ***Duration*** | long-term (4) | medium-term (3) |
| ***Magnitude*** | low (2) | low (2) |
| ***Probability*** | probable (3) | improbable (2) |
| ***Significance*** | **low (24)** | **low (14)** |
| ***Status (positive or negative)*** | negative | negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | To some degree | |

***Mitigation:***

| |
|---|
| » Fire and emergency procedures must be established for construction and operation<br>» Personnel must be trained to respond to veld fires to eradicate them as quickly as possible<br>» Fire breaks should be established where appropriate to limit incoming and outgoing veld fires |
| ***Cumulative impacts:***<br>Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact. |
| ***Residual Impacts:***<br>It should be possible to manage this impact effectively. |

### *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 bat species***

Bats will not be affected by the construction of the substation, but may be attracted to the substations due to the lighting that attracts insect prey. They have echo-location which would assist them in avoiding collisions with a building or overhead power lines. Any building within the substation (if they are included within the substation infrastructure) would be small.

Any impact will be local. It is likely to be an impact of low magnitude (in terms of the individuals and species that will be affected) and of permanent duration. It is highly improbable that the impact will occur. The overall significance of the impact is therefore rated as low.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (1) | Low (1) |
| ***Probability*** | Highly improbable (1) | Highly 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?*** | Not required | |
| ***Mitigation:***<br>» None required | | |
| ***Cumulative impacts:***<br>None. | | |
| ***Residual Impacts:***<br>None. | | |

| ***Nature: Impacts on individuals of threatened animal species*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |

| | | |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (16)** | **Low (16)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | None required | |
| ***Mitigation:***<br>None required | | |
| ***Cumulative impacts:***<br>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:***<br>Unlikely. | | |

***Nature: Impacts on indigenous natural vegetation***

There will be localised impacts associated with the construction of the substation. It has been established that the most widespread vegetation type on site is Karoo Escarpment Grassland, which is classified as Least Threatened. A large proportion of the site has been classified in the ECBCP as having high conservation value, but the components of the site equivalent to the feature in question have been identified and are not affected by the proposed infrastructure.

If the project takes place then there will have to be some clearing of vegetation for the substations. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the substation and the approach road.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (1) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (40)** | **Medium (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:***<br>» 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 wetlands***

There are a number of seasonal wetlands on site that could potentially be affected by the proposed construction of infrastructure. The substations, however, are not planned to be positioned within or immediately adjacent to mapped wetland areas.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (1) | Low (1) |
| ***Probability*** | Highly improbable (1) | Highly improbable (1) |
| ***Significance*** | **Low (8)** | **Low (8)** |
| ***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.

***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 leading to increased soil erosion and siltation of downslope areas***

Hard surfaces created as part of the development 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. The sub-station positions are located on a moderately sloping area and down-slope areas could potentially be affected by uncontrolled impacts on the site.

The potential impact is likely to be at a local scale, but may affect surrounding (down-slope) areas. It is likely to be long-term and, in a worst-case scenario, may lead to

impacts of moderate magnitude. There is some severe erosion in drainage lines in the study area that indicate that this impact could occur. Given the current position of turbines, it is assessed as improbable that this impact will occur. A comprehensive stormwater management plan must be compiled that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Long-term (4) | Medium-term (3) |
| ***Magnitude*** | Moderate (5) | Moderate to low (4) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (22)** | **Low (18)** |
| ***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:***

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*** | Regional (3) | Regional (3) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | Moderate to high (7) | Moderate to low (3) |
| ***Probability*** | Highly probable (4) | Improbable (2) |
| ***Significance*** | **Medium (56)** | **Low (20)** |
| ***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

| ***Nature: Increased risk of veld fires*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Long-term (4) | Medium-term (3) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Low (24)** | **Low (14)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | To some degree | |

***Mitigation:***

» Fire and emergency procedures must be established for construction and operation
» Personnel must be trained to respond to veld fires to eradicate them as quickly as possible
» Fire breaks should be established where appropriate to limit incoming and outgoing veld fires

***Cumulative impacts:***

Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.

***Residual Impacts:***

It should be possible to manage this impact effectively.

### *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 bat species***

Bats may collide with overhead cables, but the fact that they use echo-location for navigation indicates that they will probably not collide with such infrastructure at a high frequency. It has been evaluated that there are two near threatened bat species that

potentially occur in the area a) Schreiber's Long-fingered Bat, and b) Darling's Horseshoe Bat. The species are classified as near threatened, which is a category of lesser concern than any of the threatened categories (critically endangered, endangered or vulnerable). Both are cave-dwelling species and may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local & surroundings (2) | Local & surroundings (2) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (24)** | **Low (24)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Not required | |

***Mitigation:***

» None required

***Cumulative impacts:***

No other developments are likely to cause similar effects on bats.

***Residual Impacts:***

Some impacts are likely to occur irrespective of control measures, but mortalities may be very low.

***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 these species.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Short-term (1) | Short-term (1) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (8)** | **Low (8)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | None required | |

***Mitigation:***

None required

***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 indigenous natural vegetation***
Each pylon will require a small area to be cleared. There will therefore be localised impacts associated with the construction of each pylon. The collective impact of the entire overhead cable is likely to lead to a loss of a minimum of approximately 2 ha of natural vegetation. It has been established that the most widespread vegetation type on site is Karoo Escarpment Grassland, which is classified as Least Threatened. A large proportion of the site has been classified in the ECBCP as having high conservation value, but the components of the site equivalent to the feature in question have been identified and are not affected by the proposed infrastructure.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (1) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (40)** | **Medium (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 wetlands***
There are a number of seasonal wetlands on site that could potentially be affected by the proposed construction of overhead power lines. None of the power line towers are likely to occur within or immediately adjacent to mapped wetland areas.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Medium (4) | Low (3) |
| ***Probability*** | Improbable (2) | Highly improbable (2) |
| ***Significance*** | **Low (22)** | **Low (20)** |
| ***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.
» ensure power line towers are outside wetlands

***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***

The basal footprint of supporting pylons is likely to be very small. However, where disturbances are created, this 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 may problems, but on sloping ground, this may lead to increased erosion and siltation of downslope areas. In a number of cases there is sufficient slope to warrant concern with respects to this potential impact or the turbine is at the summit of a steep slope.

A comprehensive stormwater management plan must be compiled that 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 minimize the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabiens, weirs, rock-packing, etc.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Long-term (4) | Medium-term (3) |
| ***Magnitude*** | Low (4) | 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:***

» Rehabilitate any disturbed areas immediately to stabilise landscapes

| |
|---|
| » Erosion features must be immediately stabilized, 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*** | Regional (3) | Regional (3) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | Moderate to high (7) | Moderate to low (3) |
| ***Probability*** | Highly probable (4) | Improbable (2) |
| ***Significance*** | **Medium (56)** | **Low (20)** |
| ***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 | | |

| ***Nature: Increased risk of veld fires*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | local and surroundings (2) | local and surroundings (2) |
| ***Duration*** | long-term (4) | medium-term (3) |
| ***Magnitude*** | low (2) | low (2) |
| ***Probability*** | probable (3) | improbable (2) |
| ***Significance*** | **low (24)** | **low (14)** |
| ***Status (positive or negative)*** | negative | negative |
| ***Reversibility*** | Reversible | Reversible |

| | | |
|---|---|---|
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | To some degree | |
| ***Mitigation:***<br>» Fire and emergency procedures must be established for construction and operation<br>» Personnel must be trained to respond to veld fires to eradicate them as quickly as possible<br>» Fire breaks should be established where appropriate to limit incoming and outgoing veld fires | | |
| ***Cumulative impacts:***<br>Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact. | | |
| ***Residual Impacts:***<br>It should be possible to manage this impact effectively. | | |

### *Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed underground power line cables between turbines*

***Nature: Impacts on individuals of threatened bat species***
Except for a small loss of habitat that may support prey, underground cables will not affect flying animals. Disturbed areas should be rehabilitated as quickly as possible to ensure that a perennial vegetation cover becomes re-established. Impacts should be contained to as small an area as possible.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Medium term (3) | Medium-term (3) |
| ***Magnitude*** | Low (2) | Low (1) |
| ***Probability*** | Improbable (2) | Improbable (1) |
| ***Significance*** | **Low (12)** | **Low (5)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Not required | |
| ***Mitigation:***<br>» Rehabilitate any disturbed areas immediately to stabilise landscapes<br>» Contain impacts to as small an area as possible. Impacts should not be permitted to affect surrounding areas. | | |
| ***Cumulative impacts:***<br>No other impacts are likely to cause similar effects on bats. | | |
| ***Residual Impacts:***<br>Some impacts are likely to occur irrespective of control measures, but mortalities may be very low. | | |

| ***Nature: Impacts on individuals of threatened animal species*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permenent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Improbable (2) | Highly improbable (1) |
| ***Significance*** | **Low (16)** | **Low (8)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | None required | |
| ***Mitigation:***<br>» Avoid impacts on wetlands.<br>» Ensure natural habitat (terrestrial) is not affected more than necessary.<br>» Rehabilitate any disturbed areas immediately to stabilise landscapes<br>» Contain impacts to as small an area as possible. Impacts should not be permitted to affect surrounding areas. | | |
| ***Cumulative impacts:***<br>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:***<br>Unlikely. | | |

| ***Nature: Impacts on indigenous natural vegetation***<br>Burying the underground cables will require the digging of a trench for the entire length of the alignment of the cabling. At a minimum, it is expected that an area will be affected for a distance of over 70 km, and therefore the potential is that approximately 30 ha of habitat could be affected by the underground cables (less than 1% of the study area). It has been established that the most widespread vegetation type on site is Karoo Escarpment Grassland, which is classified as Least Threatened. A large proportion of the site has been classified in the ECBCP as having high conservation value, but the components of the site equivalent to the feature in question have been identified and are not affected by the proposed infrastructure. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (3) | Low (2) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (45)** | **Medium (40)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of*** | Yes | Yes |

| | | |
|---|---|---|
| ***resources?*** | | |
| ***Can impacts be mitigated?*** | To some degree | |

***Mitigation:***

» Align the cable alignment as much as possible along existing linear disturbances, e.g. roads on site, or the edges of cultivated lands.
» Avoid unnecessary impacts on natural vegetation. Impacts should be contained, as much as possible, within the footprint of the proposed cable alignment.
» Rehabilitate any disturbed areas immediately to stabilise landscapes.

***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 wetlands***

There are a number of seasonal wetlands on site that could potentially be affected by the proposed construction of underground cables. bThere are some turbines that are currently positioned within or immediately adjacent to mapped wetland areas and adjacent turbines may be located on either side of wetlands. Cables connecting these would be required to cross wetland features.

The impact will be of medium magnitude and of permanent duration. According to the current position of the turbines, it is definite that the impact will occur. The overall significance of the impact is rated as low.

A permit from DWA is required if there are expected to be any impacts on any wetland or water resources.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | High (7) | Medium high (6) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **High (65)** | **Medium (60)** |
| ***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 and inhibit erosion
» Obtain a permit from DWA to impact on any wetland or water resource.

***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:***<br>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*** | Regional (3) | Regional (3) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | Moderate to high (7) | Moderate to low (3) |
| ***Probability*** | Highly probable (4) | Improbable (2) |
| ***Significance*** | **Medium (56)** | **Low (20)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | To some degree | |
| ***Mitigation:***<br>» Keep disturbance of indigenous vegetation to a minimum<br>» Rehabilitate disturbed areas as quickly as possible<br>» Do not translocate soil stockpiles from areas with alien plants<br>» Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove<br>» Establish an ongoing monitoring programme to detect and quantify any aliens that may become established | | |
| ***Cumulative impacts:***<br>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:***<br>Will probably be very low if control measures are effectively applied | | |

| ***Nature: Increased risk of veld fires*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | local and surroundings (2) | local and surroundings (2) |
| ***Duration*** | long-term (4) | medium-term (3) |
| ***Magnitude*** | low (2) | low (2) |
| ***Probability*** | probable (3) | improbable (2) |
| ***Significance*** | **low (24)** | **low (14)** |
| ***Status (positive or negative)*** | negative | negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be*** | To some degree | |

| | | |
|---|---|---|
| ***mitigated?*** | | |
| ***Mitigation:***<br>» Fire and emergency procedures must be established for construction and operation<br>» Personnel must be trained to respond to veld fires to eradicate them as quickly as possible<br>» Fire breaks should be established where appropriate to limit incoming and outgoing veld fires | | |
| ***Cumulative impacts:***<br>Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact. | | |
| ***Residual Impacts:***<br>It should be possible to manage this impact effectively. | | |

***Impact tables summarising the significance of impacts on ecology (with and without mitigation) associated with the proposed access roads***

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 are approximately 92 km of internal access roads proposed however much of these will make use of existing access roads (if existing roads can be utilised, this will reduce the overall distance of new road required).

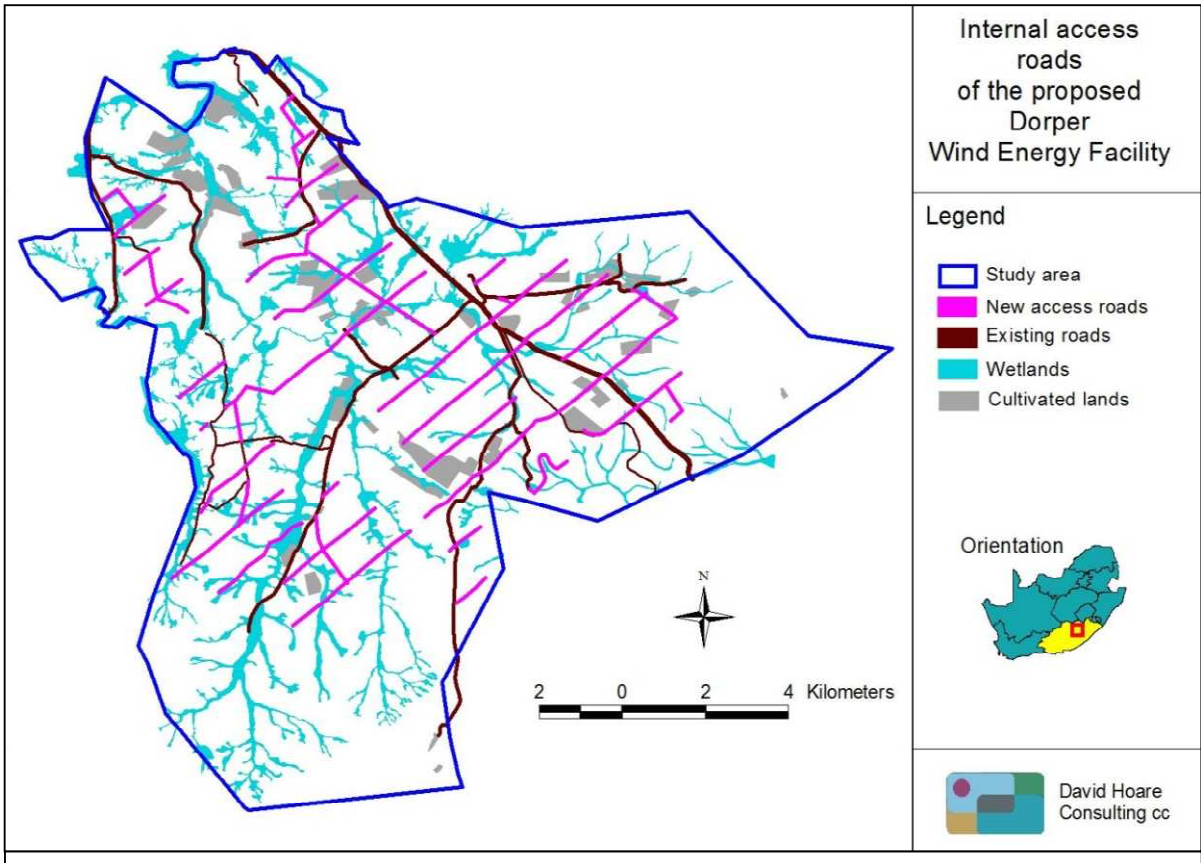



**Figure 6.4** Potential routes for proposed internal access roads

| ***Nature: Impacts on individuals of threatened bat species*** | | |
|---|---|---|
| Except for a small loss of habitat that may support prey, access roads will not affect flying animals significantly. The impact of access roads on threatened bats will therefore only affect those species directly dependant on intact habitat on site. | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (3) | Low (2) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (18)** | **Medium (16)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Not required | |
| ***Mitigation:***<br>» Using existing roads and tracks as much as possible<br>» Rehabilitate any disturbed areas immediately to stabilise landscapes<br>» Contain impacts to as small an area as possible. Impacts should not be permitted to affect surrounding areas. | | |
| ***Cumulative impacts:***<br>No other impacts are likely to cause similar effects on bats. | | |
| ***Residual Impacts:***<br>Some impacts are likely to occur irrespective of control measures, but mortalities may be very low. | | |

| ***Nature: Impacts on individuals of threatened animal species*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (2) | Low (2) |
| ***Probability*** | Improbable (2) | Highly improbable (1) |
| ***Significance*** | **Low (16)** | **Low (8)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Not reversible | Not reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | None required | |
| ***Mitigation:***<br>» Avoid impacts on wetlands.<br>» Use existing roads as much as possible.<br>» Ensure natural habitat (terrestrial) is not affected more than necessary.<br>» Rrehabilitate any disturbed areas immediately to stabilise landscapes | | |

| |
|---|
| » Contain impacts to as small an area as possible. Impacts should not be permitted to affect surrounding areas. |
| ***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 indigenous natural vegetation***

Constructing internal access roads will require an alignment that provides access to all the proposed turbines. There is a significant amount of existing roadway within the study area and a large number of turbines are within a short distance of these roads. It will, however, be necessary to construct additional sections of road to access turbine positions. At a minimum, it is expected that an area will be affected for a distance of at least 70 km. There is therefore the potential that approximately 60 ha of habitat could be affected by the construction of new road (less than 1% of the study area). It has been established that the most widespread vegetation type on site is Karoo Escarpment Grassland, which is classified as Least Threatened. A large proportion of the site has been classified in the ECBCP as having high conservation value, but the components of the site equivalent to the feature in question have been identified and are not affected by the proposed infrastructure.

If the project takes place then there will have to be some clearing of vegetation for each turbine. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbine and the approach road.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Low (3) | Low (2) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **Medium (45)** | **Medium (40)** |
| ***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:***

» Align the roads as much as possible along existing linear disturbances, e.g. roads on site, or the edges of cultivated lands.
» Avoid unnecessary impacts on natural vegetation. Impacts should be contained, as much as possible, within the footprint of the proposed cable alignment.
» Rehabilitate any disturbed areas immediately to stabilise landscapes.

***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 wetlands***

There are a number of seasonal wetlands on site that could potentially be affected by the proposed construction of access roads. There are some turbines that are currently positioned within or immediately adjacent to mapped wetland areas and adjacent turbines may be located on either side of wetlands. Access roads connecting these would have to cross wetlands.

Stormwater and runoff water must be controlled and managed to avoid siltation and surface hydrological impacts on wetlands. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local and surroundings (2) | Local and surroundings (2) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | High (7) | Medium (5) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **High (70)** | **Medium (60)** |
| ***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:***

» Align the roads as much as possible along existing linear disturbances, e.g. roads on site.
» Cross wetlands perpendicularly.
» Avoid unnecessary impacts on natural vegetation. Impacts should be contained, as much as possible, within the footprint of the proposed cable alignment.
» Obtain a permit from DWA to impact on any wetland or water resource.
» Rehabilitate any disturbed areas immediately to stabilise landscapes

***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) | Medium-term (3) |

| | | |
|---|---|---|
| ***Magnitude*** | Moderate (5) | Moderate to low (4) |
| ***Probability*** | Improbable (2) | Improbable (2) |
| ***Significance*** | **Low (22)** | **Low (18)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Partially reversible | Partially reversible |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation:***

» Align the roads as much as possible along existing linear disturbances, e.g. roads on site, or the edges of cultivated lands.
» 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 stabilized, 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*** | Regional (3) | Regional (3) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Magnitude*** | Moderate to high (7) | Moderate to low (3) |
| ***Probability*** | Highly probable (4) | Improbable (2) |
| ***Significance*** | **Medium (56)** | **Low (20)** |
| ***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 |

| ***Nature: Increased risk of veld fires*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | local and surroundings (2) | local and surroundings (2) |
| ***Duration*** | long-term (4) | medium-term (3) |
| ***Magnitude*** | low (2) | low (2) |
| ***Probability*** | probable (3) | improbable (2) |
| ***Significance*** | **low (24)** | **low (14)** |
| ***Status (positive or negative)*** | negative | negative |
| ***Reversibility*** | Reversible | Reversible |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | To some degree | |
| ***Mitigation:*** » Fire and emergency procedures must be established for construction and operation » Personnel must be trained to respond to veld fires to eradicate them as quickly as possible » Fire breaks should be established where appropriate to limit incoming and outgoing veld fires | | |
| ***Cumulative impacts:*** Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact. | | |
| ***Residual Impacts:*** It should be possible to manage this impact effectively. | | |

**Implications for Project Implementation**

Overall the proposed wind energy facility is likely to have a medium local and regional negative impact on the ecology on site, prior to mitigation. This could be reduced to medium – 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 direct, long term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc.

### *6.2.2. Conclusions and Recommendations*

There are three major vegetation types that occur in the study area, namely Karoo Escarpment Grassland, Aliwal North Dry Grassland, Stormberg Plateau Grassland, Queenstown Thornveld, Tarkastad Montane Shrubland and Southern

Drakensberg Highland Grassland. Karoo Escarpment Grassland, the most widespread vegetation type in the study area, is classified as Least Threatened as are all the other vegetation types occurring on site. According to the Eastern Cape Biodiversity Conservation Plan, a large proportion of the site is classified as having high conservation value due to it being within an escarpment zone, which is described as an important ecological corridor. The ECBCP is, however, a broad-scale planning tool and does not necessarily take into account local conditions on site. This assessment evaluated sensitivity at a site-scale and is able to more accurately depict site-specific sensitivities.

Other factors that may lead to parts of the study area having high ecological sensitivity are the presence of wetlands within the shallow drainage lines on site, presence of steep slopes in the escarpment and mountain zone and the potential presence of various plant and animal species of conservation concern.

Mountains and ridges are considered to have high ecological value due to the ecological processes that they support. Mountains, ridges and drainage lines (wetlands) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches. Steep slopes can be problematic in constructing infrastructure due to the fact that any impact can have an effect downslope from that point. Depending on the steepness and the length of the slope, particular areas may be more sensitive to disturbance than others. Any steep slopes are therefore considered to have elevated sensitivity. Potential issues that may arise from development of these areas includes erosion of substrates downslope and the impacts of stormwater runoff.

Other than protected ecosystems and threatened plant and animal species, forests and wetlands are both protected under national legislation (National Forests Act and National Wetlands Act respectively). Any impacts on these vegetation types would require a permit from the relevant National Department. There are three tree species that are protected under the National Forests Act that have a geographic distribution that includes this area. It has been evaluated that no habitat containing or suitable for these species occurs on site and it is therefore unlikely that they occur there.

There are no plant species of high conservation concern (threatened or near threatened) that could occur in available habitats in the study area. Due to the lower-level conservation status of other species, any impacts on them will not affect their conservation status, even if they occur on site. It is therefore

concluded that impacts due to the proposed wind energy facility are highly unlikely to affect plant species of high conservation concern.

There are a number of animal species of conservation concern that may occur in habitats within the study area. This includes nineteen mammal species of conservation concern (including one species classified as Endangered and three near threatened bat species), one Near Threatened frog species and two Near-Threatened reptile species. The suitability of habitats for these species was evaluated during the field survey of the site during the EIA. It was evaluated that only the 3 bat species are potentially at risk of significant impacts due to the proposed wind energy facility. The other species are unlikely to occur on site or have the ability to move away during construction and return during operation of the wind energy facility.

Most of the study area appears to still be in natural condition, although some parts may be degraded due to commercial livestock farming, cultivation and alien plant invasions. Any degraded areas on site have been classified as having low sensitivity and conservation value. All other remaining natural vegetation on site, except for that classified as having high sensitivity, is classified as having medium sensitivity. This indicates that it is natural, but does not have high sensitivity.

A risk assessment was undertaken which identified nine main potential negative impacts on the ecological receiving environment. The significance of these impacts was assessed during the EIA phase after collection of relevant field data. 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 wetlands
7. Change in runoff and drainage patterns
8. Establishment and spread of declared weeds and alien invader plants
9. Increased risk of veld fires.

Impacts were assessed separately for wind turbines, substations, internal access roads and power lines. A summary of impacts, as evaluated, is provided in the table below (Table 6.1).

It must be noted that the assessment of the impacts of the underground cabling was undertaken independently of any other infrastructure. The construction of the wind energy facility will, however, require the construction of internal access roads, which have similar impacts to the construction of underground cables.

Taken in combination, the combined impact of the internal access roads and underground cabling will never be higher than the highest individual impact of either one of them.

All infrastructure could potentially have a significant impact on natural vegetation, although it was assessed that this impact would constitute only a small area. The conservation status of the vegetation is not high and the amount of vegetation destroyed by construction of the wind energy facility will be relatively small (approximately 1-2% of the site).

Wind turbine construction is likely to have significant impacts on wetlands in the study area, due to the fact that a number of the turbines are currently situated within designated wetland areas. Internal access roads and underground cables are also likely to affect various wetland systems. Due to the more extensive impact due to underground cables and internal access roads, these components of the infrastructure will lead to impacts of high significance on wetlands. Potential impacts will have to be carefully controlled to avoid degradation of downstream areas of wetland systems.

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** | | **Substation** | | **Overhead powerlines** | | **Underground cables** | | **Access roads** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mitigation** | With out | With | With out | With | With out | With | With out | With | With out | With |
| **threatened bats** | medium (36) | medium (30) | low (7) | low (7) | low (24) | low (24) | low (12) | low (5) | low (18) | low (16) |
| **threatened animals** | low (10) | low (5) | low (16) | low (16) | low (8) | low (8) | low (16) | low (8) | low (16) | low (8) |
| **vegetation** | medium (45) | medium (40) | medium (40) | medium (35) | medium (40) | medium (35) | medium (45) | medium (40) | medium (45) | medium (40) |
| **wetlands** | medium (60) | medium (55) | low (8) | low (8) | low (22) | low (20) | high (65) | medium (60) | high (70) | medium (60) |
| **runoff/ drainage** | low (22) | low (18) | low (22) | low (18) | low (20) | low (8) | low (22) | low (18) | low (22) | low (18) |
| **alien plants** | medium (56) | low (20) | medium (56) | low (20) | medium (56) | low (20) | medium (56) | low (20) | medium (56) | low (20) |
| **veld fires** | low (24) | low (14) | low (24) | low (14) | low (24) | low (14) | low (24) | low (14) | low (24) | low (14) |

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

» A monitoring programme should be implemented to document the effect on bats. This should take place before construction (to provide a benchmark), during construction and during operation. This will provide information to quantify the impacts of the present project since such information is not available for similar projects in South Africa.
» 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 cable alignments should coincide as much as possible.

## 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

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 the 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 Korhaan, Blue Crane and Grey-crowned Crane) 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 while commuting between resource areas (croplands, nest sites, roost sites/wetlands).
» Displacement of resident/visiting raptors (especially Cape Eagle Owl, Black Harrier, Verreaux's 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 (possibly including Drakensberg Rock-jumper, Melodious Lark and Yellow-breasted Pipit), 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***<br>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 (8) | Moderate (6) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **55 (Medium)** | **45 (Medium)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Medium | High |
| ***Irreplaceable loss of resources?*** | Possible | Probably not |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>» Abbreviating construction time<br>» Scheduling activities around avian breeding and/or movement schedules<br>» Lowering levels of associated noise<br>» Reducing the size of the inclusive development footprint.<br>» More detail is contained in the EMP (Appendix O). | | |

| |
|---|
| ***Cumulative Impacts:*** |
| None, as long as no other wind energy developments are built 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*** | Moderate (6) | Low (4) |
| ***Probability*** | Definite (5) | Definite (5) |
| ***Significance*** | **65 (Medium-High)** | **55 (Medium)** |
| ***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.

***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 (Medium)** | **52 (Medium)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |

| | | |
|---|---|---|
| ***Irreplaceable loss of resources?*** | Possible | Possible |
| ***Can impacts be mitigated?*** | Slightly | |

***Mitigation:***

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

***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.

***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 (Medium-High)** | **30 (Medium)** |
| ***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 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 impact on avifauna is potentially of medium - high significance, but could be reduced to a medium-low significance with the implementation of mitigation measures. 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 the EMP in Appendix O), from pre-construction and into the operational phase of the project.

In terms of the findings of the monitoring programme, the extent of development proposed for certain high-lying or high relief areas where Cape Vultures and other soaring species might be most likely to fly should be reviewed. The turbine locations most likely to be affected would probably be those few within 500m of the escarpment drop-off and cliff faces along the southern periphery of the proposed development (Refer to Figure 7.1 in the following chapter). These high sensitivity avifaunal areas require further monitoring during all four seasons to provide more certainty regarding bird movements within these areas. This comprehensive monitoring should take place prior to development occurring within these areas. Other areas would only require bird monitoring once the facility is operational.

### *6.3.1. Conclusions and Recommendations*

Although the development area does not impinge significantly on any major bird fly-ways, unique landscape features, it does affect threatened grassland habitat. Populations of regionally or nationally threatened (and impact susceptible) bird species are likely to occur within or close to the turbine arrays, and the proposed facility may have a detrimental effect 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 impacts of wind energy developments on South Africa avifauna.

The proposed facility is likely to have a significant, long-term impact on the avifauna of the area, and may have a negative effect on key rare, Red-listed and/or endemic species. The most obvious and immediate negative impacts are likely to be on Cape Vulture and other soaring raptors, bustards species and crane species. These birds may be disturbed by construction of the facility, may lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (cranes), or may suffer mortalities in collisions with the turbine blades and power lines (vultures and cranes). These effects, which may also impact on other priority species, 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.

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 activity will tend to involve minor earthworks on localised, small construction footprints around each turbine or substation with interleading gravel access roads. No alternative sites have been proposed but the structures can be shifted within the broader site to accommodate sensitive areas, if these occur where structures are planned.

The most important 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 depends on the present quality of the topsoil and the agricultural potential of the area.

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. These are considered to be of low significance at this stage due to the localised and limited scale of activity proposed.

There are no known important or prominent geological features and the parent rock is unlikely to be detrimentally affected by the proposed activity, as there are no deep excavations planned. Therefore, the impact on the natural soil profile is the primary focus of this study as it is important for the sustainability of ecosystems.

Main impacts with regards to the geological environment include:

» **Soil degradation**

The proposed activity will more than likely 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. 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. Negative impacts can be mitigated to a large degree by effective implementation of appropriate environmental management measures.

Soil degradation is not always apparent during the period of activity and can occur at a later stage, therefore having delayed effects.

The Erosion Index for South Africa indicates that the site has a moderate to high susceptibility to erosion. The erodibility index is determined by combining the effects of slope and soil type, rainfall intensity and land use. Soil erosion concerns will be greatest at the foot of steep slopes where run-off velocity is high and soil types are typically fine-grained and unconsolidated. Erosion gulleys will tend to form along natural drainage lines where run-off is concentrated and where vegetation is limited or has been disturbed or damaged (e.g. overgrazing).

Sheet-wash, rill and gulley erosion silty sandy (loamy) topsoil or alluvium related to poor agricultural practice and overgrazing is commonplace in many areas in the Eastern Cape but does not seem to be the case on this particular study area. Minor localised erosion is evident but there is no evidence of severe erosion. However, the removal of vegetation will contribute negatively to the erosion potential of the site. Gulley and sheet erosion will be the dominant processes, but significant wind erosion of disturbed areas can occur in fine-grained, dry or cohesionless soil (such as topsoil). Construction activity on slopes will tend to promote soil erosion and these areas will require more protection before, during and after construction.

The proposed development layout indicates that turbines are concentrated on upland areas of low relief. This is to maximise wind and reduce construction access difficulty. 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.

» **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.

Fortunately, the proposed activity is unlikely to have significant impact in this regard because the proposed structures are unlikely to involve excavations

deeper than 1-2 m and, where required, access roads can probably be constructed without significant cuttings.

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

| ***Nature: Soil degradation – Removal of vegetation and soil under footprint of structures and roads affecting soil formation processes on the site.*** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | N/A |
| ***Duration*** | Permanent (5) | N/A |
| ***Magnitude*** | Low (4) | N/A |
| ***Probability*** | Definite (5) | N/A |
| ***Significance*** | **Moderate (50)** | N/A |
| ***Status*** | Negative | N/A |
| ***Reversibility*** | Irreversible | N/A |
| ***Irreplaceable loss of resources?*** | Yes but minor | Minor |
| ***Can impacts be mitigated?*** | No | |
| ***Mitigation:*** N/A | | |
| ***Cumulative impacts:*** Numerous localised small footprints associated with structures but no significant cumulative impacts envisaged. Cumulative impacts can be minimised if construction is staged across the site. | | |
| ***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 | Insignificant |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>» Minimise disturbance areas.<br>» Rehabilitate soil and vegetation.<br>» Stage earthworks in phases across site so that exposed areas are minimised.<br>» Keep to existing roads, where practical, to minimise impacts on undisturbed | | |

| |
|---|
| ground. |
| ***Cumulative impacts:***<br>Numerous localised small footprints associated with structures but no significant cumulative impacts envisaged. Cumulative impacts can be minimised if earthworks are staged so that exposed areas are minimised. |
| ***Residual impacts:***<br>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:***<br>» Prevent unnecessary excavations and stockpiling.<br>» Restrict height of stockpiles to reduce compaction.<br>» Restrict number of access roads and minimise traffic.<br>» Rehabilitate soil and vegetation in areas of activity.<br>» Keep to existing roads, where practical, to minimise impact on undisturbed ground.<br>» Stage earthworks in phases to minimise exposed ground. | | |
| ***Cumulative impacts:***<br>Numerous localised small footprints associated with structures but no significant cumulative impacts envisaged. | | |
| ***Residual Impacts:***<br>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*** | Practically irreversible | Practically irreversible |

| | | |
|---|---|---|
| ***Irreplaceable loss of resources?*** | Moderate | Minor |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>» Restrict zone of disturbance.<br>» Implement effective erosion control measures.<br>» Stage construction in phases.<br>» Keep to existing roads, where practical, to minimise impact on undisturbed ground. | | |
| ***Cumulative impacts:***<br>Numerous localised small footprints associated with structures but no significant cumulative impacts envisaged. | | |
| ***Residual Impacts:***<br>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*** | Minor (2) | Minor (2) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low (24)** | **Low (24)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Irreversible | Irreversible |
| ***Irreplaceable loss of resources?*** | Yes but insignificant | Yes but insignificant |
| ***Can impacts be mitigated?*** | To a degree | |
| ***Mitigation:***<br>» Restrict zone of disturbance and plan excavations carefully.<br>» Plan any new access roads taking contour lines into consideration to minimise cutting and filling operations.<br>» Keep to existing roads, where practical, to minimise impacts on undisturbed ground. | | |
| ***Cumulative impacts:***<br>Numerous localised small footprints associated with structures but no significant cumulative impacts envisaged. | | |
| ***Residual Impacts:***<br>Minor – some visual impact along access roads | | |

| ***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:***<br>» Install anti-erosion measures such as silt fences in disturbance areas. | | |
| ***Cumulative impacts:***<br>Numerous localised small footprints associated with structures and roads but no significant cumulative impacts envisaged if effective mitigation measures are in place. | | |
| ***Residual Impacts:***<br>Minor localised movement of soil across site | | |

**Implications for Project Implementation**

The findings of the geology and soils study indicate the most important impacts on geology and soils include soil degradation (including erosion). The significance of the main direct impacts that have been identified is considered low to moderate due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. A basic assessment of the potential geotechnical constraints on the project indicates no insurmountable problems which have may have an impact on the design and construction processes.

### *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 localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. No severe erosion exists on the site.

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.

## 6.5. Assessment of Potential Impacts on Heritage Sites and Palaeontology

Middle Stone Age artefacts occur widely over the area proposed for development, however, they are predominantly in a secondary context owing to general farm

and construction disturbances. It appears that the Middle Stone Age artefacts occur between the ground surface and 30-50 cm below ground as observed by the stone artefacts eroding out of dongas. However, some stone artefacts may still be *in situ* within areas that have not yet been disturbed. Later Stone Age artefacts occur mainly around the koppies and rocky outcrops, but are also found together with surface scatters of Middle Stone Age and historical artefacts. Stone walling seems to occur randomly on the landscape which may have been used prehistorically, historically and recently. Informal burial grounds and graves older than 60 years occur are also expected to occur on the landscape.

The wind farm site is underlain by several units of potentially fossiliferous continental sediments in the upper, Mesozoic part of the Karoo Supergroup. These Karoo rocks are extensively intruded by unfossiliferous dolerites of the Early Jurassic Karoo Dolerite Suite. Among the Mesozoic units small, peripheral exposures of the Burgersdorp and Elliot Formations are unlikely to be directly affected by the proposed development. Late Caenozoic alluvial sediments in the eastern portion of the study area are of low palaeontological sensitivity.

In contrast, the Late Triassic Molteno Formation that underlies the greater part of the study area is internationally famous for its remarkably rich assemblages of plant and insect fossils. These include the richest Triassic (c. 220 million year old) fossil floras recorded anywhere in the world, as well as some of the oldest known dinosaur trackways. Several key fossil sites are already recorded within the Molteno Formation in the Molteno – Sterkstroom outcrop area. Excavations for new access roads and wind turbine emplacements may well disturb, damage or destroy scientifically valuable fossils during the construction phase of this development.

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

| ***Nature: Disturbance to possible archaeological sites***<br>Potential loss of stone artefact scatters and possible sites during construction | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | International (5) | International (5) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | High (10) | Low (1) |
| ***Probability*** | High (5) | Improbable (1) |
| ***Significance*** | **Medium (50)** | **Medium (30)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes | |

| | | |
|---|---|---|
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation measures:***

» If any of the existing buildings are planned to be demolished during the course of development, a built-environment heritage specialist or historian must be appointed to assess the significance of the built environment and historical buildings.
» The grave and burial areas must be identified and cordoned off prior to the commencement of development so that no negative impact and vandalism occurs.
» Once the exact coordinates for the wind turbines are established an archaeologist should be appointed to inspect the exact and immediate surrounding area for possible sites.
» An ECO should be appointed during the construction phases to observe whether any depth of deposit and in situ archaeological material remains is uncovered.
» If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to SAHRA.
» Construction managers/foremen should be informed of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

***Cumulative impacts:***
Low

***Residual impacts:***
Low

***Nature: Disturbance or destruction of valuable fossil heritage within the potentially highly fossiliferous Molteno Formation***
Several key fossil sites are already recorded within the Molteno Formation to the northeast of Indwe. Excavations for new access roads and wind turbine emplacements may well disturb, damage or destroy scientifically valuable fossils during the construction phase of this development.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | International (5) | International (5) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Very high (10) | Very high (10) |
| ***Probability*** | Highly probable (4) | Improbable (1) |
| ***Significance*** | **High (80)** | **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:***

» It is recommended that a qualified palaeontologist be commissioned to carry out a field scoping study of the entire study area before construction commences.
» 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 a low-medium cultural sensitivity, however there are a number of recommendations which must be considered in order to reduce potential impacts on heritage resources from a high to a more acceptable medium-low significance. There is also the potential for impacts on fossil resources, this impact is potentially of high significance but can be reduced to low significance with the implementation of mitigation and monitoring measures.

### *6.5.1. Conclusions and Recommendations*

The area is of a low-medium cultural sensitivity, however the following recommendations must be considered:

» If any of the existing buildings are planned to be demolished during the course of development, a built-environment heritage specialist or historian must be appointed to assess the significance of the built environment and historical buildings.

» The grave and burial areas must be identified and cordoned off prior to the commencement of development so that no negative impact and vandalism occurs.

» Once the exact coordinates for the wind turbines are established an archaeologist should be appointed to inspect the exact and immediate surrounding area for possible sites. Further recommendations may follow after the investigation.

» An ECO should be appointed during the construction phases to observe whether any depth of deposit and in situ archaeological material remains is uncovered.

» It is unknown whether any in situ archaeological sites/remains, and human remains would be uncovered during construction. However, if concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Albany Museum and/or the South African Heritage Resources Agency so that systematic and professional investigation/excavation can be undertaken. Appendix A of the heritage EIA study (Appendix K) contains a list of possible archaeological sites that maybe found in the area.

» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

In terms of potential impacts on fossils, it is recommended that a qualified palaeontologist be commissioned to carry out a field scoping study of the entire study area before construction commences. The main purpose of the field scoping study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase might be required. Relocation of wind turbines, roads or other developments is unlikely to be necessary on palaeontological grounds alone provided that appropriate mitigation is ensured. Mitigation would involve the recording and judicious collection of fossil material and associated geological data.

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.

The methodology utilised to identify issues related to the visual impact included the following activities:

» The creation of a detailed digital terrain model of the potentially affected environment.
» The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
» The identification of sensitive environments upon which the proposed facility could have a potential impact.
» The creation of viewshed analyses from the proposed development area (for the purposes of this study a separate viewshed indicating the impact of the substation only, as well as a viewshed combining both substation and wind turbines has been included) in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

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 (244 in total) at an offset of 90m (maximum proposed turbine hub height) above average

ground level in order to simulate a worst-case scenario. 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 below (Figure 6.5) clearly illustrates the influence of the topography and the placement of the wind energy facility infrastructure within a valley formed by the Bamboesberg to the south-east of Molteno. The highest frequency of exposure is expected be contained within the valley immediately surrounding the facility. The facility will however be visible to a lesser extent, up and down the valley to the north-west and south-east. The raised escarpment and mountainous terrain to the north and south of the facility will act a visual buffer, effectively shielding most of the facility from observers.

The result of the viewshed analyses for the proposed Dorper Wind Energy Facility's provisional layout is shown below in Figures 6.6 to 6.8. The viewshed analyses not only indicate areas from where the wind turbines or infrastructure would be visible, but also indicate the potential frequency of visibility (i.e. how much is exposed).

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the relatively natural state of the environment and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from a distance.

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed wind energy facility and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

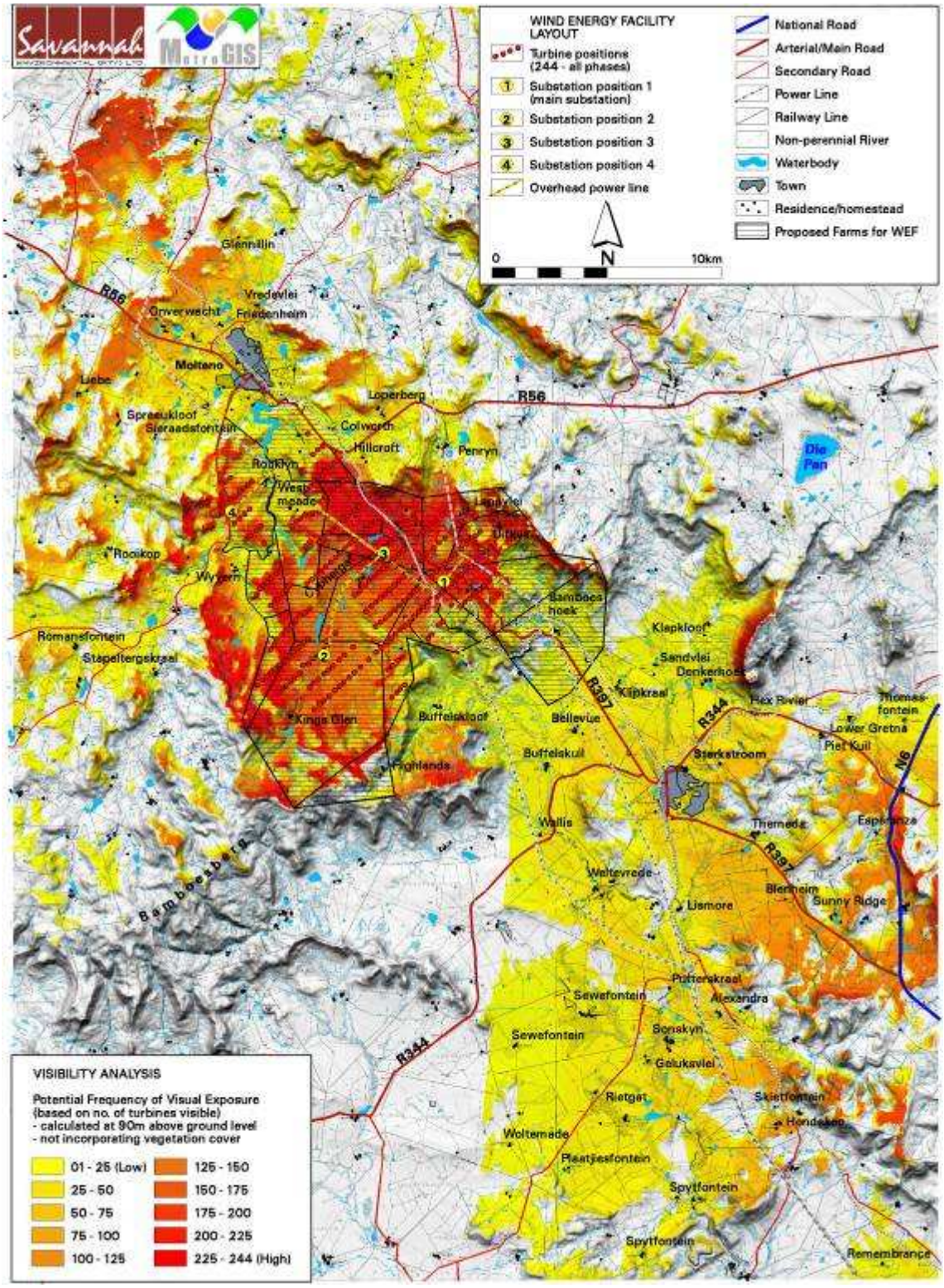



**Figure 6.5** Potential visual exposure of the proposed wind turbines

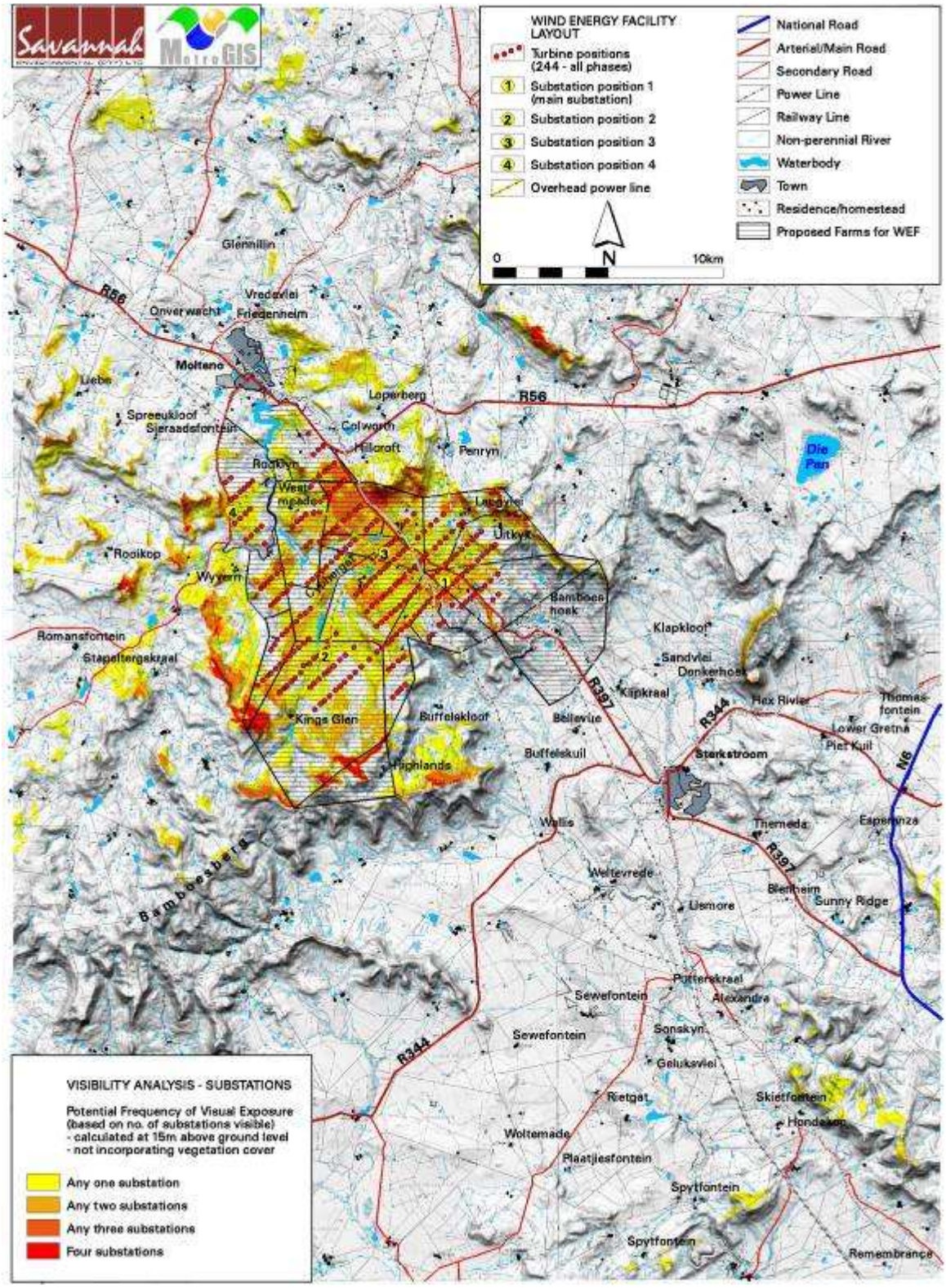



**Figure 6.6** Potential visual exposure of the proposed substations

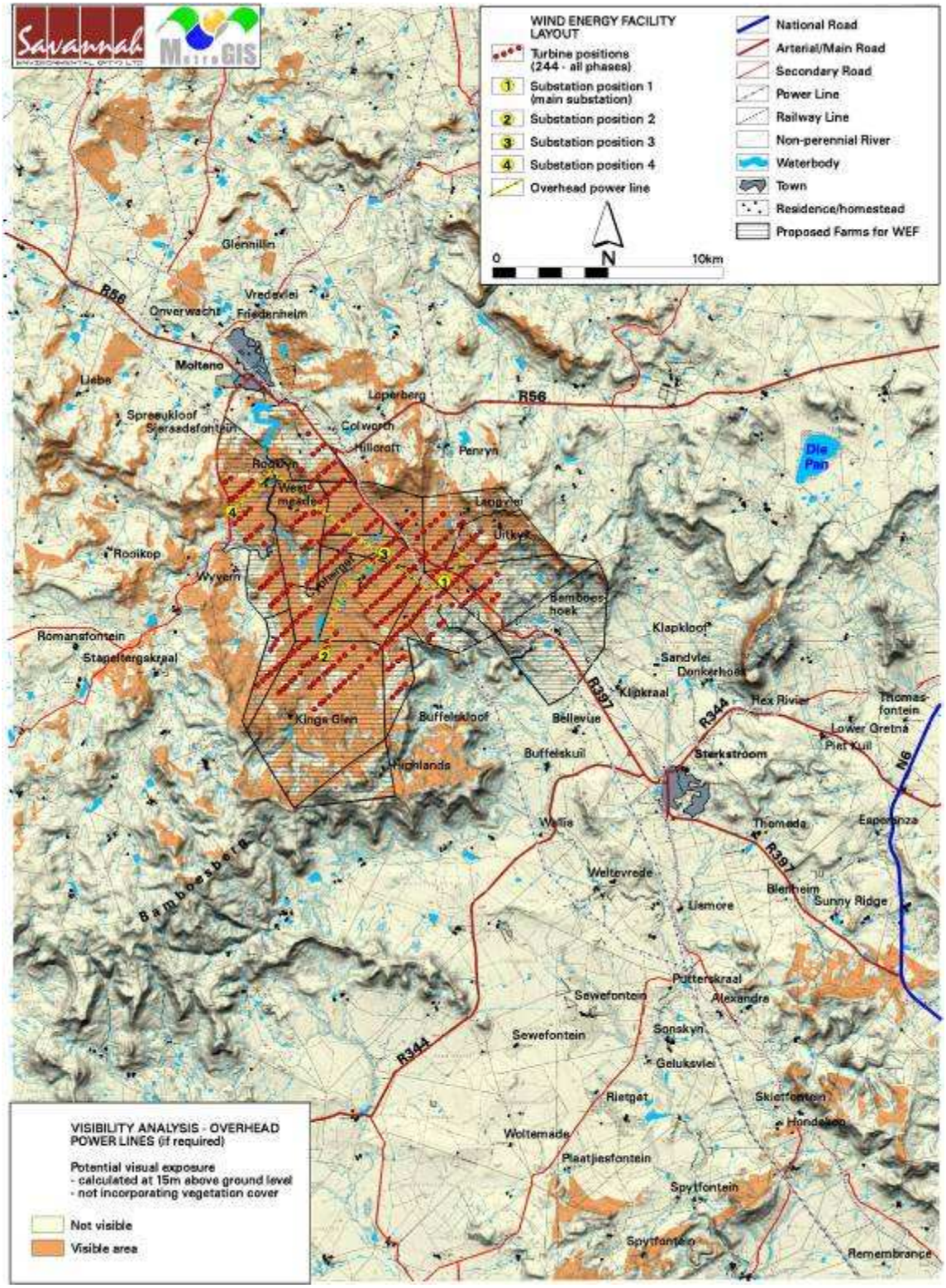



**Figure 6.7** Potential visual exposure of the proposed power lines

One main area of high viewer incidence and potentially negative perception of the proposed facility was identified for the study area. This constitutes a 200m buffer zone along the arterial roads (R56, R397 and R344) and the secondary roads (such as Aitchison road ext.) running through and in the vicinity of the proposed

site. This represents the area with the highest potential sightings of the facility (by people travelling along these roads).

A secondary area that includes the farmsteads of Cyphergat, Langvlei, Uitkyk, King's Glen and West Meade (inside the valley bowl and situated within a 5km radius of the wind energy facility) was identified. These areas, although not carrying a very high viewer incidence rating, contain residents and general public who can be seen as potentially sensitive visual receptors.

Within 5km of the site lies the town of Molteno (about 5km north-west of the site) as well as a number of homesteads, agricultural holdings and game farms between the R397, R344 and Aitchison Road extension. These harbour potentially sensitive visual receptors upon which the construction of the facility could have a negative visual impact. Viewer incidence would be significantly higher for the town of Molteno than for the surrounding homesteads. Similarly, the town of Sterkstroom would have a higher viewer incidence than the scattered homesteads located between 5 and 20km. Figure 6.8 indicated the location of these areas.

The remainder of the study area, excluding the abovementioned zones, is greatly devoid of random observers or sensitive visual receptors, or the topography and distance of potential receptors to the facility decreases visibility drastically. This zone consists predominantly of grazing land or vacant natural land with a low to insignificant occurrence of observers.

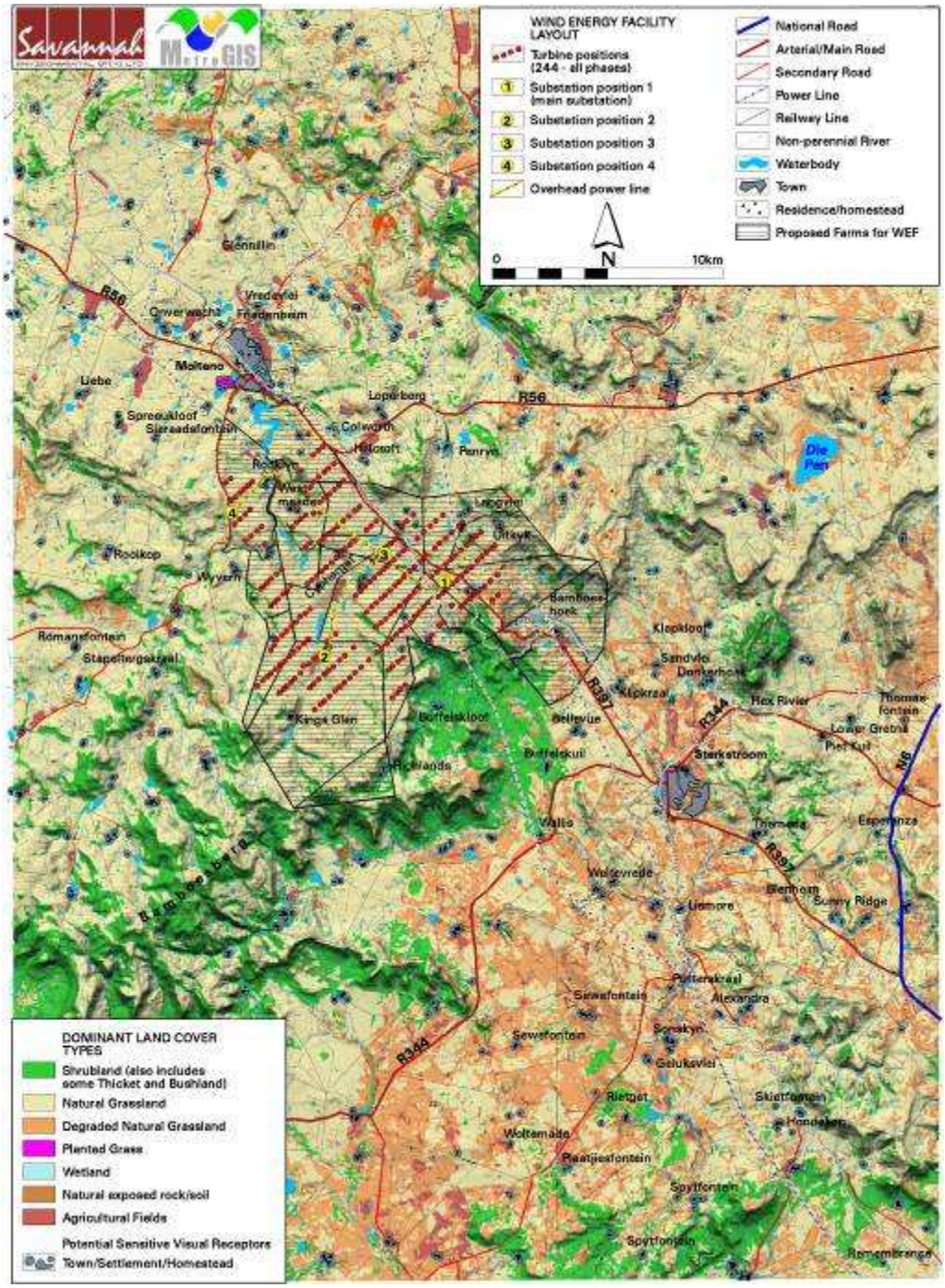



**Figure 6.8**: Land cover/land use map indicating potential sensitive visual receptors

» **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 6.8 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 wind energy facility on the upper escarpment of the valley within which the proposed facility is situated.

Isolated pockets with a ranking of very high visual impact also occur within the 5km radius of the facility. These include a band of approximately 1km in width running along the R397 (where it traverses the development site) as well as a band along Aitchison Road extension.

Farm settlements that can expect to be visually influenced (i.e. experience a potentially high visual impact) by the proposed facility, within a 5km radius of the development, include: Rooklyn, West Meade, Wyvern, Cyphergat, Hillcroft, Langvlei, Uitkyk, Buffelskloof, Kings Glen and Highlands.

Homesteads and settlements within or close to a 5km radius of the development that may experience moderate to high visual impacts include: Spreeukloof, Sieraandsfontein, Loperberg, Colworth, Penryn and Bamboeshoek.

Homesteads and settlements beyond 5km (roughly 5km to 10km) from the development that may experience moderate to high visual impacts include: Onverwacht, Vredevlei, Friedenheim, Klapkloof, Sandvlei, Donkerhoek, Klipkraal, Bellevue, Buffelskuil, Wallis, Stapeltergskraal, Romansfontein and Liebe.

Major (national/arterial/main) roads that may fall within areas of potentially high visual impact include a section of the R397 Road running through the development site, as well as the R56. Parts of the R344 and R397 south-east of the wind energy facility, where partial views of the facility are expected, and sections of the R56 (north of the development area), fall within an area rated as having a potentially moderate to high visual impact.

Roads traversing mountainous terrain and the extended valley to both the north-west and south-east of the facility may afford observers a clear, yet long distance (beyond 10km), view of the proposed development and may constitute low to moderate visual impact.

The towns of Molteno and Sterkstroom (built-up areas with existing structures and visual clutter) are not expected to experience a significant visual impact from the proposed development. Indications are that the development would likely have a low visual impact on Sterkstroom. Residents of Molteno may only have

partial views of the wind farm from distances close to the 5km limit, constituting a moderate potential visual impact.

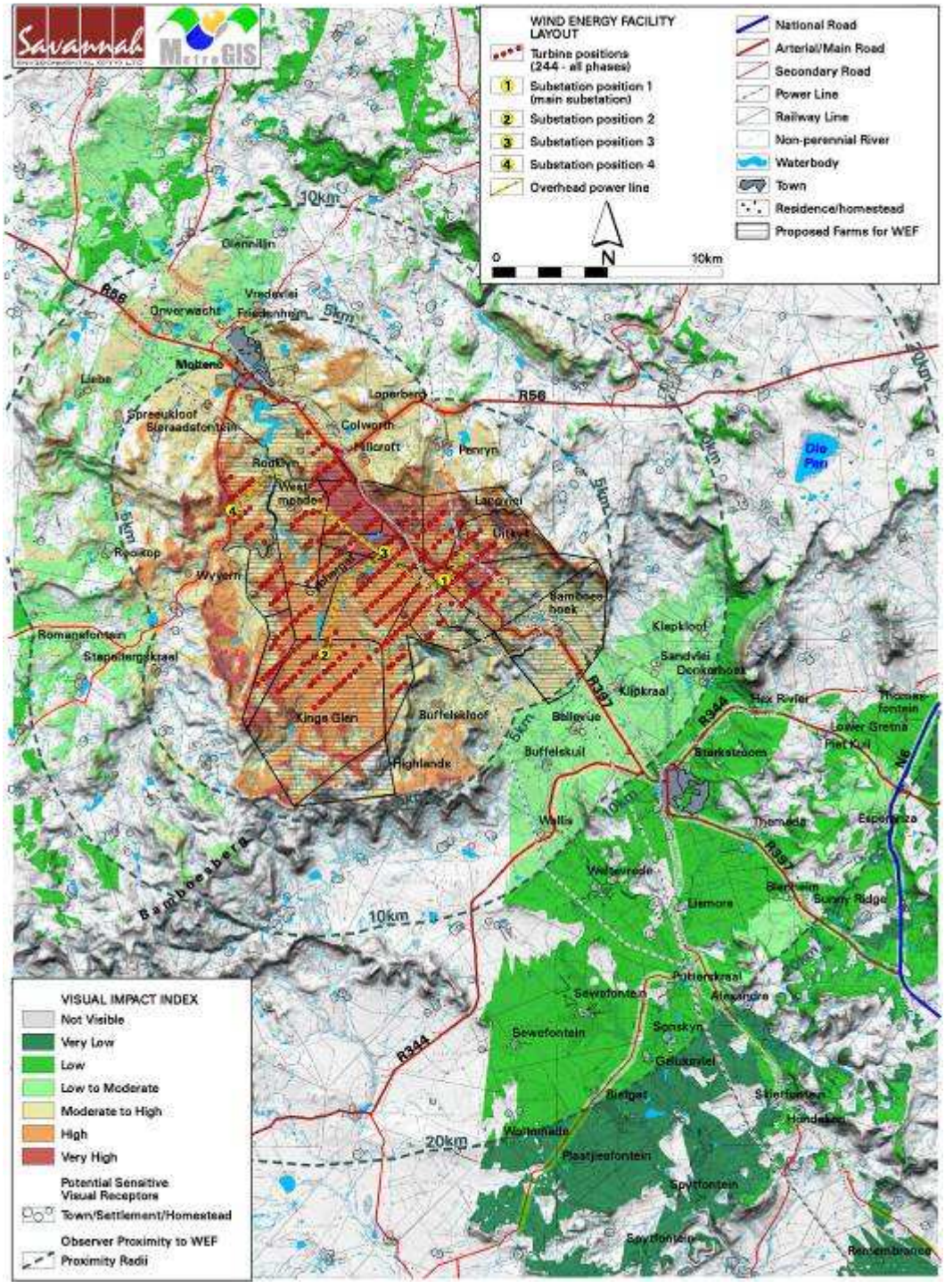



**Figure 6.9:** Visual impact index of the proposed Dorper Wind Energy Facility

» **Distribution power lines**

The overhead power lines (linking the facility with the various substations), the substations 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 impact. It is clear that visibility of both the overhead lines and the substations fall within the viewshed of the greater facility and are over shadowed by this, thus reducing their overall impact.

Some localised visual impacts may occur, but are not expected to be significant in comparison the construction of the wind turbines. The overhead power lines linking the facility with the various substations, the substations 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 impact.

» **Lighting**

The area earmarked for the placement of the substations within the Dorper Wind Energy Facility and the surrounding areas (within a radius of approximately 2 to 3km) is not densely populated. The effects of security and after-hours operational lighting (flood lights) of the substations, in terms of light trespass and glare, are therefore lower in significance due to a low incidence of sensitive visual receptors.

The placement of the substations within the facility footprint and within the valley bowl is preferred as this limits visual impact further afield.

The primary source of light pollution stemming from the facility will be in the form of "glare light", which is not as intense as flood lighting. The source of this 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.

Another potential lighting impact is the phenomenon 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. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The overall potential for mitigation is generally 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.

***Impact tables summarising the significance of visual impacts associated with the wind energy facility (with and without mitigation)***

| | |
|---|---|
| ***Nature of Impact: Potential visual impact on users of roads***<br>Visual impacts on national/arterial/main roads as well as secondary (local) roads are expected to be high to very high, within a 5km radius of the proposed development. | |
| ***Extent*** | Local **(4)** |
| ***Duration*** | Long term **(4)** |
| ***Magnitude*** | High **(4.5)** |
| ***Probability*** | High probability **(4)** |
| ***Significance*** | **High (62)** |
| ***Status (positive or negative)*** | Negative |
| ***Reversibility*** | Recoverable **(3)** |
| ***Irreplaceable loss of resources?*** | No |
| ***Can impacts be mitigated during operational phase?*** | No |
| ***Mitigation:***<br>» Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other possible mitigation. | |

| |
|---|
| ***Cumulative impacts:***<br>The construction of up to 244 wind turbines, 4 new substations and overhead power lines, together with the existing power line infrastructure (2 existing lines) will increase the cumulative visual impact within the region.<br><br>The phased development approach (i.e. the construction of 244 turbines over a number of years) 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:***<br>Not applicable |

| ***Nature of Impact: Potential visual impact on residents of homesteads/settlements in close proximity to the proposed facility.*** | |
|---|---|
| The visual impact on the town of Molteno and other homesteads (that occur within a radius of 5km from the proposed facility) is expected to be moderate to high. | |
| ***Extent*** | Local **(4)** |
| ***Duration*** | Long term **(4)** |
| ***Magnitude*** | High **(4)** |
| ***Probability*** | High probability **(4)** |
| ***Significance*** | **Moderate to high (60)** |
| ***Status (positive or negative)*** | Negative |
| ***Reversibility*** | Recoverable **(3)** |
| ***Irreplaceable loss of resources?*** | No |
| ***Can impacts be mitigated during operational phase?*** | No |
| ***Mitigation:***<br>» Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other mitigation possible. | |
| ***Cumulative impacts:***<br>The construction of up to 244 wind turbines, 4 new substations and overhead power lines, together with the existing power line infrastructure (2 existing lines) will increase the cumulative visual impact within the region.<br><br>The phased development approach (i.e. the construction of 244 turbines over a number of years) 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:***<br>Not applicable | |

| | |
|---|---|
| ***Nature of Impact: Potential visual impact on residents of homesteads/settlements in medium proximity to the proposed facility.***<br>The visual impact on the town of Sterkstroom and other homesteads (that occur between the 5-10km radii) is expected to be low. The visual impact on the towns, settlements and farmsteads located within a 10-20km radius of the facility is expected to be low to negligible and is not reflected in the table below. | |
| ***Extent*** | Local **(4)** |
| ***Duration*** | Long term **(4)** |
| ***Magnitude*** | Low **(2)** |
| ***Probability*** | Medium to low **(2.5)** |
| ***Significance*** | **Low (30)** |
| ***Status (positive or negative)*** | Negative |
| ***Reversibility*** | Recoverable **(2)** |
| ***Irreplaceable loss of resources?*** | No |
| ***Can impacts be mitigated during operational phase?*** | No |
| ***Mitigation:***<br>» Decommissioning: removal of the wind turbines and ancillary infrastructure at relevant time of closure of the facility. No other mitigation possible. | |
| ***Cumulative impacts:***<br>The construction of up to 244 wind turbines, 4 new substations and overhead power lines, together with the existing power line infrastructure (2 existing lines) will increase the cumulative visual impact within the region.<br><br>The phased development approach (i.e. the construction of 244 turbines over a number of years) 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:***<br>Not applicable | |

» **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 6.10:** View west from R397 as it runs through the proposed facility, approximately 10km north-west of Sterkstroom. This view is indicative of what will be seen from the access gate of the farm Uitkyk.

**Figure 6.11:** View northwest towards facility from R397 just outside Sterkstroom. The facility appears barely visible.

Refer to Visual Assessment (Appendix J) for the remainder of the photo-simulations.

**Implications for Project Implementation**

The visual impact assessment indicates a core area of potentially high visual impact within a 5km radius of the proposed wind energy facility on the upper escarpment of the valley within which the proposed facility is situated. Isolated pockets with a ranking of very high visual impact also occur within the 5km radius of the facility, including a band of approximately 1km in width running along the R397 (where it traverses the development site) as well as a band along Aitchison Road extension. Certain farm settlements within a 5km radius of the development can expect to be visually influenced (i.e. experience a potentially high visual impact). Homesteads and settlements within or close to a 5km radius of the development may also experience moderate to high visual impacts. Major roads that may fall within areas of potentially high visual impact include a section of the R397 running through the development site, as well as the section of the R56 within 5 km of the site. Parts of the R344 and R397 south-east of the proposed wind energy facility, where partial views of the facility are expected, and sections of the R56 (north of the development area), fall within an area rated as having a potentially moderate to high visual impact.

Homesteads and settlements 5km to 10km from the development may experience low to moderate visual impacts. Roads traversing mountainous terrain and the extended valley to both the north-west and south-east of the facility may afford observers a clear, yet long distance (beyond 10km), view of

the proposed development and may also constitute low to moderate visual impact.

The towns of Molteno and Sterkstroom (built-up areas with existing structures and visual clutter) are not expected to experience a significant visual impact from the proposed development. The development would have a low visual impact on Sterkstroom, and residents of Molteno would only have partial views of the wind energy facility, constituting a moderate potential visual impact.
The visual impact on the towns, settlements and farmsteads located within a 10-20km radius of the facility is expected to be low to negligible.

### *6.6.1. Conclusions and Recommendations*

The construction and operation of the Dorper Wind Energy Facility and its associated infrastructure will have a visual impact on the natural scenic resources and rural character of this region. The rural and relatively unspoiled wide-open vistas surrounding the facility will be transformed for the entire operational lifespan of the plant.

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. In addition, no vegetation screening or landscaping would be able to hide structures of these dimensions. The facility and its surrounds should generally be maintained in a neat and appealing way. This also applies to the associated infrastructure (power lines, substations, access roads, etc.) of the facility.

Where visual impacts are significantly exacerbated by their elevated location within the landscape, possible mitigation includes the placement of the wind turbines in relation to the topography (in cases where the turbine layout has not yet been finalised). The analysis of the potential visual exposure of the proposed turbine layout highlights the fact that the placement of the turbines on top of the ridge line (escarpment) tends to increase the frequency of exposure, while the valley surrounding the site and mountainous terrain to the north and south tends to break the frequency of exposure of receptors situated beyond these. Should the majority of the turbines be planned within the valley/central core of the development footprint, the potential visual impacts to the surrounding area could be reduced.

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.

## 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 (-3 dB penalty will be imposed due to the height of the wind turbine generators),
» 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**

The following activities were assumed to take place simultaneously together with the normal activities observed during the site visit:

- Various traffic on the gravel road from the R397 to the workshop area along the (gravel) road. Traffic is estimated as a maximum of 5 trucks with 5 light construction vehicles (maximum) per hour travelling at an average speed of 50 km/h on the gravel road. T his should represent the

worst case scenario. This peak traffic would also increase the average traffic on the R397 slightly.

- Worst case would be five sites where various activities are taking place simultaneously. 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. Activities are taking place for 12 hours during the 16 hour day-time period.
  - Quarry activities to obtain aggregate rock and rock removal. Front end loader and crushing/screening generates the most noise. Activities take place for 8 hours during the 16 hour day-time period.
  - Surface preparation prior to civil work. This could be the removal of topsoil, or the preparation of an access road. Activities take place for 8 hours during the 16 hour day-time period.
  - Preparation of foundation area. Activities take place for 10 hours during the 16 hour day-time period.
  - Erecting of the wind turbine generator. Activities take 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 to the various activity sites. All vehicles to travel less than 40 km/h, with 2 trucks and 4 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 atmospheric conditions would be ideal for sound propagation.

» **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 M).

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

| ***Nature: Noise associated with numerous simultaneous construction activities***<br><br>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 50 dBA<br><br>High (8) | Critically depends on the equipment selected as well as which mitigation measures are implemented.Making use of grader instead of a bulldozer for site preparation, together with the workshop and turbine installation activities, all limited to an 8-hour operation could reduce the noise levels at certain receptors. A good relationship with the closest receptors will also minimize any potential for annoyance.<br>High (7) |
| ***Probability*** | Possible (2)<br>While the sound intensity and change in ambient sounds are high, it would be limited during the day when the farmer and workers are busy with their normal farming activities. | Improbable (1) |
| ***Significance*** | **Medium (34)** | **Low (18)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | N/A | N/A |
| ***Can impacts be mitigated?*** | Yes | |

| |
|---|
| ***Mitigation:***<br>Depending on the findings and recommendations of the Operational phase noise analysis, it might be required to relocate one or more turbines further away from the potential sensitive receptor. If a turbine is relocated, the construction activity would also be relocated in so reducing both the intensity and probability of the noise impact.<br><br>Other mitigation options include:<br>» Reducing the number simultaneous activities when working close to a receptor.<br>» Ensuring that all equipment and machinery are well maintained and equipped with silencers (where possible).<br>» Considering the noise emission characteristics of equipment when selecting equipment for a project/operation.<br>» Working together with the local communities, and prior warning when a noisy activity is to take place.<br>» Only conduct very noisy activities between 10am and 4pm.<br>» Conduct noisy activities in the shortest possible time (site preparation with bulldozer and civil work using an excavator)<br>» 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:***<br>This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. |
| ***Residual impacts:***<br>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***<br><br>Acceptable Rating Level: rural district with little road traffic: 35 dBA outside during day. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Regional – impact will extent more than 1,000 meters from activity (3) | Regional – impact will extent more than 1,000 meters from activity (3) |
| ***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 35 dBA<br><br>High (10) | By modelling the proposed mitigation, where problematic turbines were relocated further than 1,000 meters from potential sensitive receptors<br><br>High (6) |
| ***Probability*** | Definite (5) | Possible (2) |

| | | |
|---|---|---|
| ***Significance*** | **High (90)** | **Low (28)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | N/A | N/A |
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation:***

An increase in noise level of 7 dBA or more above ambient could be considered a nuisance, but not an impact of high significance. The following are best practice mitigation options to reduce noise emission levels below 35 dBA at night.

» Turbines highlighted in Table 7.12 of the Noise Impact EIA study (Appendix M) could be removed or moved to an area where it is more than 1,000 meters from receptors. This is especially relevant to turbines 41, 50, 51, 52, 96, 98 and 99. If not further than 1,000 meters from potential receptors remodelling should be conducted.
» Turbines 49, 53, 89, 91, 92, 97, 201, 204, 205 and 206 could be moved more than 500 meters from the current receptors where they have impacts.
» The noise emission specifications of wind turbine generators must be considered when selecting the equipment. This could be smaller equipment, quieter equipment or both. In particular the developer could consider smaller or quieter equipment for turbines 49, 53, 91, 92, 97, 201, 204, 205 and 206.
» Installation of noise abatement measures on affected homesteads (sensitive receptors)
» A combination of the options proposed above.

Refer to Noise specialist study (Appendix M) 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.

**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 high 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 farm do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

### *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 wind farm 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 high significance. It is critical that the developer consider the mitigation options as proposed in this document to reduce the significance of the impact to a more acceptable low.

Should the layout change significantly, it is recommended that the new layout be remodelled/reviewed (if any turbines are within 1,000 meters from a potentially sensitive receptor) 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.

This report should also be made available to all potential sensitive receptors in the area, with 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.

With the implementation of the mitigation actions the significance of the impact could be reduced.

## 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 information from other wind energy facilities the total estimated capital expenditure associated with the construction of 244 wind turbines is in the region of R 5-6 billion. The construction phase is expected to extend over a period of 24-30 months and create approximately 400 employment opportunities. This includes 350 associated with the construction of access roads and foundations etc and an additional 30-60 jobs associated with the installation of the turbines. Initial indications are that the majority of the construction workers will be accommodated in the closest towns of Molteno and Sterkstroom. Some may also be accommodated in Queenstown. |

Based on information provided by the developer it is estimated that approximately 160 (40%) and 160 (40%) of the construction phase employment opportunities will be for low and semi skilled job categories respectively. The potential therefore exists for the project to create a significant number of employment opportunities for members for the local community. The majority of these are likely to be Historically Disadvantaged Individuals (HDI's). The proposed development will also create an opportunity to provide on-site training and increase skills levels. In this regard the developer has indicated that a budget will be set aside for the implementation of skills development and mentorship programme that is in line with the national Accelerated and Shared Growth Initiative for South Africa.

The total wage bill for the construction phase will be in the region of R 104 million. Of this total approximately 42 million will be earned by low and semi-skilled workers. The potential employment and wage income opportunities associated with the proposed wind energy facility therefore represents a significant opportunity for members from the local community, the majority of whom are likely to be HDI's. The high levels of employment in the area (as high as 60%) and low levels of income (62% of families have no income or an income below R10 000 per annum) highlight the significance of the potential social benefits.

In terms of business opportunities for local companies, the expenditure of R 5-6 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 Inkwanca economy are likely to be limited. The local hospitality industry in and around Motleno and Sterkstroom 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.

| | **Without enhancement** | **With enhancement** |
|---|---|---|
| ***Extent*** | Local – Regional (2)<br>(Rated as 2 due to potential opportunities for local communities) | Local – Regional (4)<br>(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*** | **Medium (32)** | **Medium (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 Dorper Wind Farm 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 Rainmaker Energy Projects should meet with representatives from the Inkwanca 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 Dorper Wind Farm 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

- Dorper Wind Farm 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, Dorper Wind Farm should assist local HD companies to complete and submit the required tender forms and associated information.
- The Inkwanca 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 upgrade and improve skills levels in the area.

***Residual impacts:***

Improved pool of skills and experience in the local area.

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

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.

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 be also damaged. Stock and game losses may also result from gates being left open and/or fences being damaged. This issue is regarded as a key issue given that livestock farming (cattle and sheep) is the main farming activity in the study area. O ne of the affected landowners, Mr. van Straaten

did, however, indicate that stock losses were an existing problem in the area, and that he lost approximately 50 sheep per annum to stock thieves and wild animals.

It is assumed that the owners of the key properties that will be affected have entered into a lease agreement with Dorper Wind Farm and, as part of the lease agreement, all damage to roads, fences and farm gates will be repaired. The costs of the repairs will be borne by the developer.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (2)<br>(Rated as 2 due to potential severity of impact on local communities) | Local (1)<br>(Rated as 1 due to potential severity of impact on local communities) |
| ***Duration*** | Very short term for community as a whole (1)<br>Long term-permanent for individuals who may be affected by STD's etc (5) | Very short term for community as a whole (1)<br>Long term-permanent for individuals who may be affected by STD's etc (5) |
| ***Magnitude*** | Minor for community as a whole (2)<br>High-Very High for specific individuals who may be affected by STD's etc (10) | Minor for community as a whole (2)<br>High-Very High for specific individuals who may be affected by STD's etc (10) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low** for the community as a whole **(15)**<br>**Moderate-High** for specific individuals who may be affected by STDs etc **(51)** | **Low** for the community as a whole **(12)**<br>**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, Dorper Wind Farm should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories.

» Dorper Wind Farm and the contractor should develop a Code of 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.

» Dorper Wind Farm 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.

» Where required, the contractor should make the necessary arrangements to allowing workers from outside the area to return home over weekends and or on a regular basis during the 6-8 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 over-night on the site.

» 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 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. However, as indicated above, Dorper Wind Farm have entered into an agreement with the affected landowners whereby the company will compensate damages to farm property. It is assumed that this includes loss of productive land.

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 final footprint of disturbance associated with 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 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.

One of the affected landowners, Mr. van Straaten, also indicated that he felt that the construction phase would not disrupt his farming activities since the developers have promised keep to farm roads and truck in water for construction activities.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (3)<br>(Rated as 3 due to potential severity of impact on local farmers) | Local (1) |
| ***Duration*** | Short term (2) | Short term (2) |
| ***Magnitude*** | Low (4) | Minor (2) |

| | | |
|---|---|---|
| | (Due to reliance on agriculture and livestock for maintaining livelihoods) | |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low (27)** | **Low (15)** |
| ***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:***

» Dorper Wind Farm should, in consultation with the local farmers, 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 Rain Maker Energy Projects and the contractors before the contractors move onto site.

» Dorper Wind Farm 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 Dorper Wind Farm, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities.

» 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 Dorper Wind Farm 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 Dorper Wind Farm 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.

***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. This issue is regarded as a key issue given that

livestock farming (cattle and sheep) is the main farming activity in the study area.

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 town of Molteno and Sterkstroom and the generally poor level of services, including emergency services in the Eastern Cape.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (4)<br>(Rated as 4 due to potential severity of impact on local farmers) | Local (2)<br>(Rated as 2 due to potential severity of impact on local farmers) |
| ***Duration*** | Very short term (1) | Very short term (1) |
| ***Magnitude*** | Moderate- due to reliance on livestock for maintaining livelihoods (6) | Low (4) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Medium (33)** | **Low (21)** |
| ***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 | No |
| ***Can impacts be mitigated?*** | Yes | Yes |

***Mitigation Measures:***

» The contractor must ensure that open fires on the site for cooking or heating are not allowed except in designated areas.

» The contractor must ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include 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.

» The contractor must provide adequate fire fighting equipment on-site.

» The contractor must provide fire-fighting training to selected construction staff. This must take place before construction activities commence.

» 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.***
The movement of heavy construction vehicles during the construction phase will damage roads and create noise, dust and safety impacts for other road users. As indicated in the Inkwanca IDP (2009/2010) most of the roads linking the rural settlements are generally in poor conditions and the backlog in terms of roads in maintenance in the municipal area stands at 95%.

Based on the information provided by the client, between 5 and 8 large reticulated transport vehicles will be required per turbine. These vehicles will be used to transport the components of the wind turbines from either East London or the Coega Harbour along the N6. The total number of vehicles or vehicle trips associated with construction phase will therefore be in the region of 1 220-1 952 (244 turbines x 5-8 trips per turbine). The movement of heavy construction related vehicles may, therefore, have the potential to exacerbate the current poor condition of the affected roads in the area, which in turn would pose an additional safety threat to other road users. The movement of large, slow moving vehicles may also impact on other road users. However, this impact is likely to be low given the large volume of heavy vehicles that use the N6 is an important transportation route connecting the Eastern Cape with the hinterland. However, as indicated below, it is recommended that trips be planned to avoid weekends, public holidays and the start and end of school holidays when the volume of traffic on the N6 is likely to be higher.

In terms of damage to internal farm roads, it assumed that Dorper Wind Farm have entered into an agreement with the affected landowners whereby the company will compensate damages to farm property. It is assumed that this includes damage to internal farm roads. The findings of the Social Impact EIA study also indicate that the issues related to the movement of heavy vehicle traffic during the construction phase can be effectively mitigated. These issues are therefore not regarded as significant concerns.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (2)<br>(Rated as 2 due to potential severity of impact on local farmers) | Local (1) |
| ***Duration*** | Short term (2) | Short term (2) |
| ***Magnitude*** | Minor (2) | Minor (2) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low (18)** | **Low (15)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Yes | |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be*** | Yes | |

| ***mitigated?*** | |
|---|---|

***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.***

This issue relates to the potential long-term impact of the wind energy facility on existing farming activities, specifically the loss of grazing available for sheep and other livestock. The loss of land to the facility may result in the affected farming operations may become uneconomical due the loss of land for grazing.

The significance of the impacts is 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. The final footprint of disturbance associated with facility also tends 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. One of the affected landowners, Mr. van Straaten indicated that he felt that the proposed facility would not pose any disruption his farming activities. Mr. PW Gordon Grant also indicated that the benefits associated with proposed facility would outweigh the negative impacts. The benefits included rentals paid to affected landowners the creation of employment opportunities.

In addition, it is assumed that Dorper Wind Farm have entered into an agreement with the affected landowners whereby the company will compensate damages to farm property. It is assumed that this includes the loss of productive farmland. PW Gordon Grant (Landowner) said that he felt that the risks associated with labour on-site would be minimal since they would be bussed in and out of the wind energy facility site and no labour camps would be established. The latter point is in conflict.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (2) | Local (1) |
| ***Duration*** | Long term-permanent if disturbed areas are not rehabilitated (5) | Short term if damaged areas are rehabilitated (2) |
| ***Magnitude*** | Minor, due to limited loss of land (2) | Minor (2) |
| ***Probability*** | Definite (5) | Highly Probable (4) |
| ***Significance*** | **Moderate (45)** | **Low (20)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Yes, in the long term if facility is dismantled and area is rehabilitated | |
| ***Irreplaceable loss of resources?*** | No, disturbed areas can be rehabilitated | No, disturbed areas can be rehabilitated |
| ***Can impacts be mitigated?*** | Yes, however, loss of farmland cannot be avoided during operational phase | |

***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 Environmental Consultants appointed to undertake the EIA (Savannah Environmental).
» The implementation of the Rehabilitation Programme should be monitored by the ECO;
» Compensation should be paid to farmers that suffer a permanent loss of land due to the establishment of the facility. Compensation should be paid by Dorper Wind Farm and based on accepted land values for the area. The findings of the SIA indicate that the farmers affected by the proposed project are being compensated for the loss of land.

***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. However, due to small scale there will be no significant cumulative impacts and disturbed areas can also be rehabilitated.

***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***

In general, all those interviewed about the proposed Dorper Wind Energy Facility indicated that the project would have a positive impact on the area in terms of local job creation and skills development opportunities. Based on information provided by the developer approximately 20-50 full time employment opportunities will be created. 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. The initial local employment opportunities associated with the proposed facility are therefore likely to be limited. However, the developer is committed to the implementation of an effective skills development and mentorship programme to address this issue. The creation of 20-50 permanent positions in an area where employment opportunities are limited represents a positive social impact regardless of the significance.

The local hospitality industry in Molteno and Sterkstroom may benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc) who are involved in the company and the project but who are not linked to the day-to-day operations. However the facility requires limited maintenance (once every 6 months). The number of annual site visits will therefore be limited and as such the benefits to the local hospitality sector will also be limited.

| | **Without enhancement** | **With enhancement** |
|---|---|---|
| ***Extent*** | Local (2) | Local (3) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (2) | Low (4) |
| ***Probability*** | Probable (3) | Highly probable (4) |
| ***Significance*** | **Low (24)** | **Medium (44)** |
| ***Status (positive or negative)*** | Positive | Positive |
| ***Reversibility*** | N/A | |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be enhanced?*** | Limited opportunity due to small scale of project | |

***Enhancement Measures:***

» See cumulative impacts.

***Cumulative impacts:***

The cumulative benefits will be dependent upon the success of the skills development and training programme.

***Residual impacts:***

See cumulative impacts.

***Nature: Potential impact on local tourism***

This issue relates to the potential benefit to local tourism in the Inkwanca Municipality by creating a potential tourist attraction. The local landowner interviewed indicated that the current tourism opportunities and attractions in the area were limited and that the establishment of the proposed facility may create an attraction and in so doing benefit local tourism in the area. However, this benefit is likely to be limited.

| | **Without enhancement** | **With enhancement** |
|---|---|---|
| ***Extent*** | Local (1) | Local (2) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (2) | Minor (2) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low (21)** | **Low (24)** |
| ***Status (positive or negative)*** | Positive | Positive |
| ***Reversibility*** | Yes | |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be Enhanced?*** | Yes | |

***Enhancement Measures:***

» Dorper Wind Farm should liaise with representatives from the Inkwanca Municipality and local tourism representatives to raise awareness of the proposed wind energy facility.

» Dorper Wind Farm 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.

» In order to maximise the benefits of the information board to the broader community it is recommended that the information be presented in the two main languages of the Eastern Cape, namely English and Xhosa.

***Cumulative impacts:***

Potential benefit for local tourism in the Emalahleni 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.

The Inkwanca Municipal Manager, Mr. Ncube, indicated that he felt that the proposed facility was located in a good area in terms of wind conditions and would assist the Municipality to reduce its carbon footprint. There is also an expectation from the Municipality that some of the energy generated from the facility will be supplied to the surrounding areas and in so doing alleviate the current problems associated with intermittent power outages. However, it was acknowledged that this assistance might come through facility providing increased power to the grid.

| | **Without enhancement** | **With enhancement** |
|---|---|---|
| ***Extent*** | Local, Regional and National (4) | Local, Regional and National (4) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Low (4) | Moderate (6) |
| ***Probability*** | Highly Probable (4) | Highly Probable (4) |
| ***Significance*** | **Medium (48)** | **High (56)** |
| ***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.
» Investigate the option of providing energy to the proposed Elitheni Coal Mine.
» Maximise the public's exposure to the project via an extensive communication and advertising programme.

***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: Loss of productive agricultural land due to the establishment of a wind energy facility and the impact on farmers livelihoods***

Is it assumed that Dorper Wind Farm have entered into an agreement with the affected landowners whereby the company will compensate damages to farm property. It is assumed that this also includes compensation for loss of productive farmland. As far as any arable cultivation is concerned, the fact that the turbines will be placed far apart would mean that cultivation would still be possible between the structures.

| | **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 Environmental Consultants appointed to undertake the EIA (Savannah Environmental).
» The implementation of the Rehabilitation Programme should be monitored by the ECO.
» Compensation should be paid to farmers that suffer a permanent loss of land due to the establishment of the facility. Compensation should be paid by Dorper Wind Farm and 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.

***Cumulative impacts:***

Potential minor loss of agricultural employment opportunities associated with loss of land.

***Residual impacts:***

See cumulative impacts.

***Nature: Visual impact associated with the proposed wind turbines and the potential impact on the areas rural sense of place.***

Visual impacts are discussed in detail in section 6.6 above.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (2) | Minor (2) |
| ***Probability*** | Highly Probable (4) | Highly Probable (4) |
| ***Significance*** | **Low (28)** | **Low (28)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Yes. Wind turbines can be removed. | |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be*** | Yes | |

| | |
|---|---|
| ***mitigated?*** | |

***Mitigation Measures:***

» The recommendations contained in the Visual Impact Assessment (Appendix J) should be implemented.

***Cumulative impacts:***

Potential impact on current rural sense of place. However, due to small scale of facility proposed the impact would be limited.

***Residual impacts:***

See cumulative impacts.

***Nature: Potential visual impact and impact on sense of place associated with power lines***

The visual and sense of place impacts associated with the proposed transmission lines will to some extent be mitigated by the presence of the existing transmission lines (400kV and 132 kV), electrified railway line and the Carrickmore. The transmission lines associated with the proposed facility will also be located for the most part within the existing servitudes and as such the visual impact and impact on sense of place will be reduced.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (2) | Minor (2) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Low (21)** | **Low (21)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Yes | |
| ***Irreplaceable loss of resources?*** | No, disturbed area can be rehabilitated | |
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation Measures:***

» The visual and sense of place impacts associated with the proposed transmission lines cannot be effectively mitigated. However, it is recommended that where possible the new lines should be located within the existing corridors and new substations should not be located on ridgelines or areas that are visually sensitive. The areas disturbed by the construction of the power lines and substations should also be rehabilitated. Measures for rehabilitation are contained in the EMP (Appendix O).

» The measures listed above to address the potential impacts associated with the construction phase also apply to the construction of power lines and substations.

» The recommendations contained in the Visual Impact Assessment (Appendix J) should be implemented.

***Cumulative impacts:***

Limited visual and impact on sense of place.

***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.

### *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** | Medium (Positive impact) | Medium (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** | Low (Negative impact) | Low (Negative impact) |
| **Risk of veld fires** | Medium (Negative impact) | Low (Negative impact) |
| **Impact of heavy vehicles and construction activities** | Low (Negative impact) | Low (Negative impact) |
| **Loss of farmland** | Low (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** | Low (Positive impact) | Medium (Positive impact) |
| **Impact on tourism** | Low (Positive) | Low (Positive) |
| **Promotion of renewable energy projects** | Medium (Positive impact) | Medium (Positive impact) |
| **Impact on farming activities** | Low (Negative impact) | Low (Neutral impact) |
| **Visual impact and impact on** | Low | Low |

| | | |
|---|---|---|
| **sense of place** | (Negative impact) | (Negative impact) |

Due to the relatively large scale of the proposed Dorper Wind Energy Facility (up to 244 turbines) the proposed project does have the potential to benefit the local Inkwanca economy. At the same time the potential negative impacts can be addressed.

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 establishment of the proposed Dorper Wind Energy Facility near Molteno in the Eastern Cape Province is supported by the findings of the Social Impact Assessment.

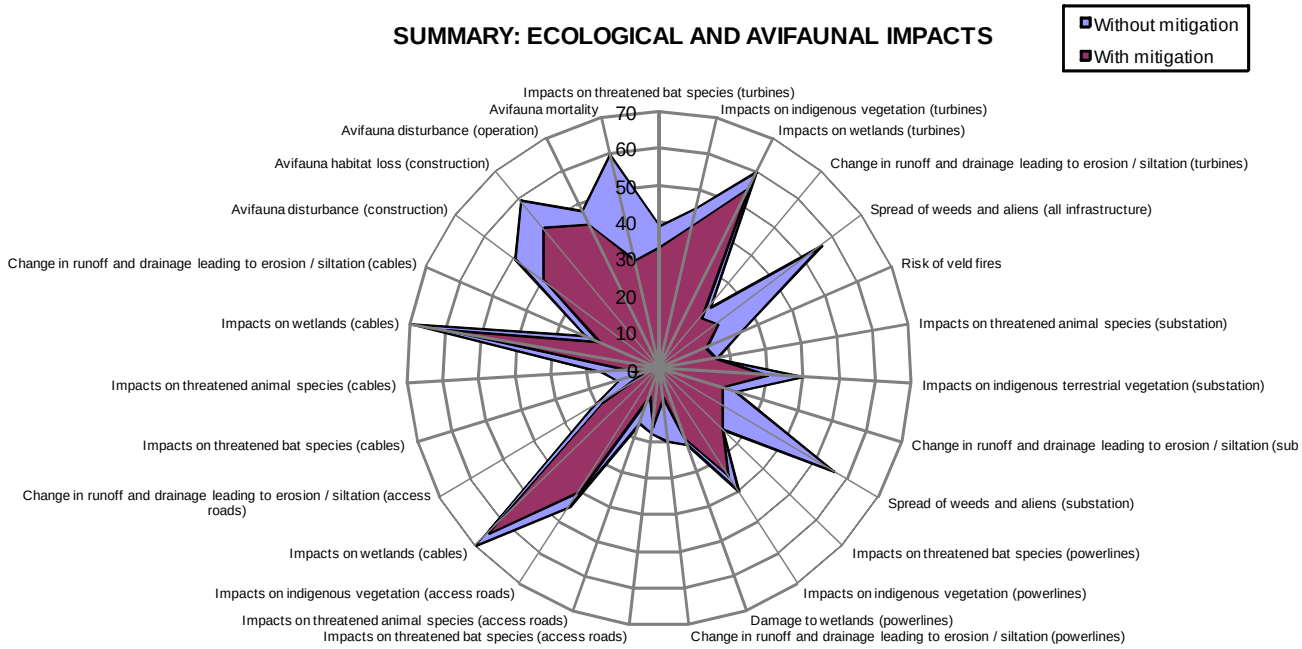
## 6.9. Summary of All Impacts

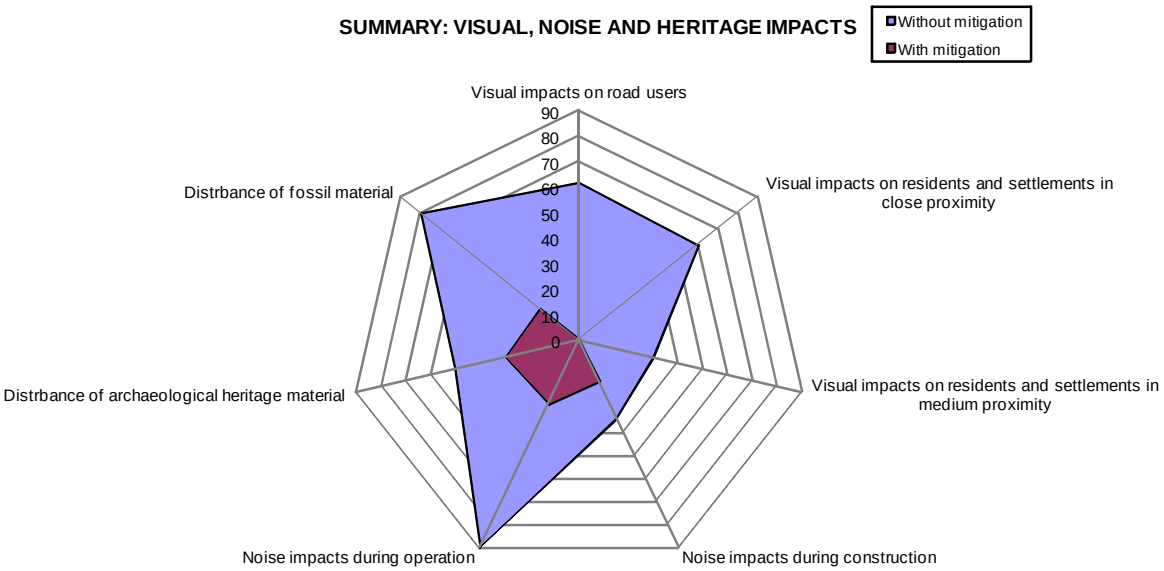
As a summary of the potential impacts identified and assessed through the EIA process, the following provide a diagrammatic representation of the significance ratings for the potential ecological, visual and social impacts.

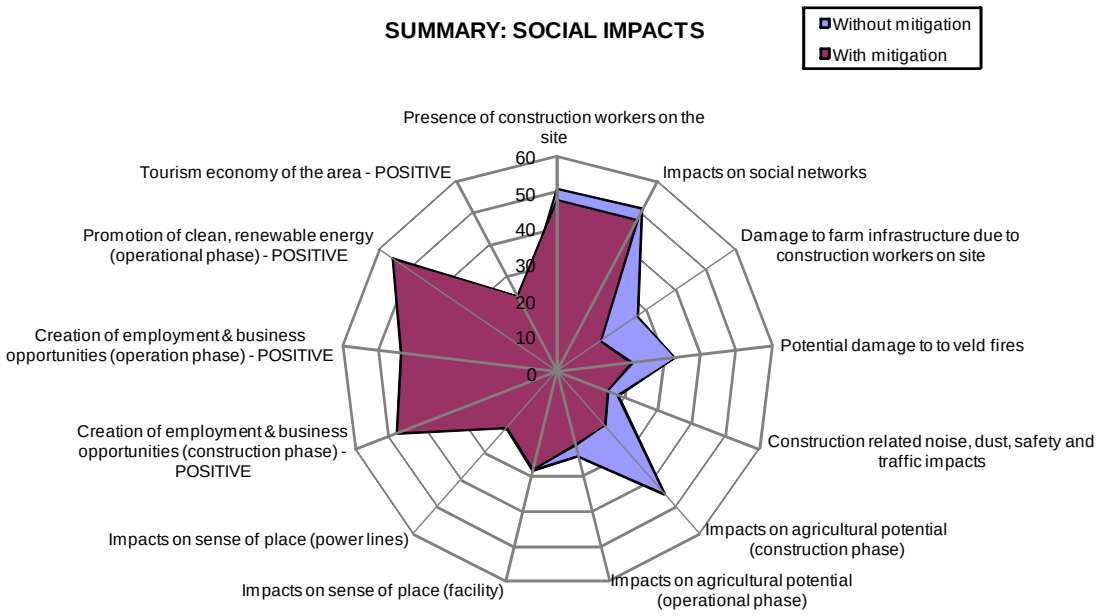
As indicated in Chapter 3, the significance weightings for potential impact have been rated as follows:

» **< 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:** 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).

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.




SUMMARY: VISUAL, NOISE AND HERITAGE IMPACTS
Without mitigation
With mitigation
Visual impacts on road users
Visual impacts on residents and settlements in close proximity
Visual impacts on residents and settlements in medium proximity
Noise impacts during construction
Noise impacts during operation
Distrbance of archaeological heritage material
Distrbance of fossil material
90
80
70
60
50
40
30
20
10
0


SUMMARY: SOCIAL IMPACTS
Without mitigation
With mitigation
Presence of construction workers on the site
Impacts on social networks
Damage to farm infrastructure due to construction workers on site
Potential damage to to veld fires
Construction related noise, dust, safety and traffic impacts
Impacts on agricultural potential (construction phase)
Impacts on agricultural potential (operational phase)
Impacts on sense of place (facility)
Impacts on sense of place (power lines)
Creation of employment & business opportunities (construction phase) - POSITIVE
Creation of employment & business opportunities (operation phase) - POSITIVE
Promotion of clean, renewable energy (operational phase) - POSITIVE
Tourism economy of the area - POSITIVE
60
50
40
30
20
10
0

## 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 244 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.

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 G - N) and are listed in the tables in section 7.2 above.

# CONCLUSIONS AND RECOMMENDATIONS CHAPTER 7

Dorper Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within Inkwanca Local Municipality in the Eastern Cape Province. The proposed facility is referred to as the Dorper Wind Energy Facility. The proposed wind energy facility is to be developed by Rainmaker Energy Projects (Pty) Ltd.

A study area of approximately 132 $km^2$ is being considered as a larger study area for the construction of the proposed wind energy facility, and would include:

» Up to 244 **wind turbine** units (up to 90 m high steel tower and nacelle; up to 100 m diameter rotor - consisting of 3x50m blades);
» **Concrete foundations** (approximately 20m x 20m x 2m) to support the turbine towers;
» Underground electrical distribution cabling between the turbines;
» Up to four **substations** (the largest being up to 150 x 250 m) on the site in an appropriate position to receive generated power via underground distribution cabling from each wind turbine;
» **Power lines** (132 kV distribution lines) linking the 4 substations directly into the existing Eskom transmission lines traversing the site;
» An **access road** to the site from the main road/s within the area;
» **Internal access roads** to each wind turbine to link the turbines on site (approximately 3-6 m in width); and
» A **workshop area** for storage and maintenance.

The wind energy facility is proposed on the following farms: Spreeukloof (portion 18), Paarde Kraal (portion 7), Uitekyk (portions 1 and 3), Farm 68 (portion 4), Cypher Gat (portions 1, 2, 3, 4, 5, 6, 7, and 9 and remaining extent), Highlands (remaining extent), Tolkop (portions 1 and 4) and Post Houers Hoek (remaining extent).

Due to the proposed extent of the full facility, the project is proposed to be developed in phases. The first phase will include the establishment of 100 MW of generating capacity, or approximately 60 turbines. The second phase will include the establishment of an additional 200 MW (~120 turbines). The third phase will include the establishment of the final 100 MW of generating capacity (~60 turbines).

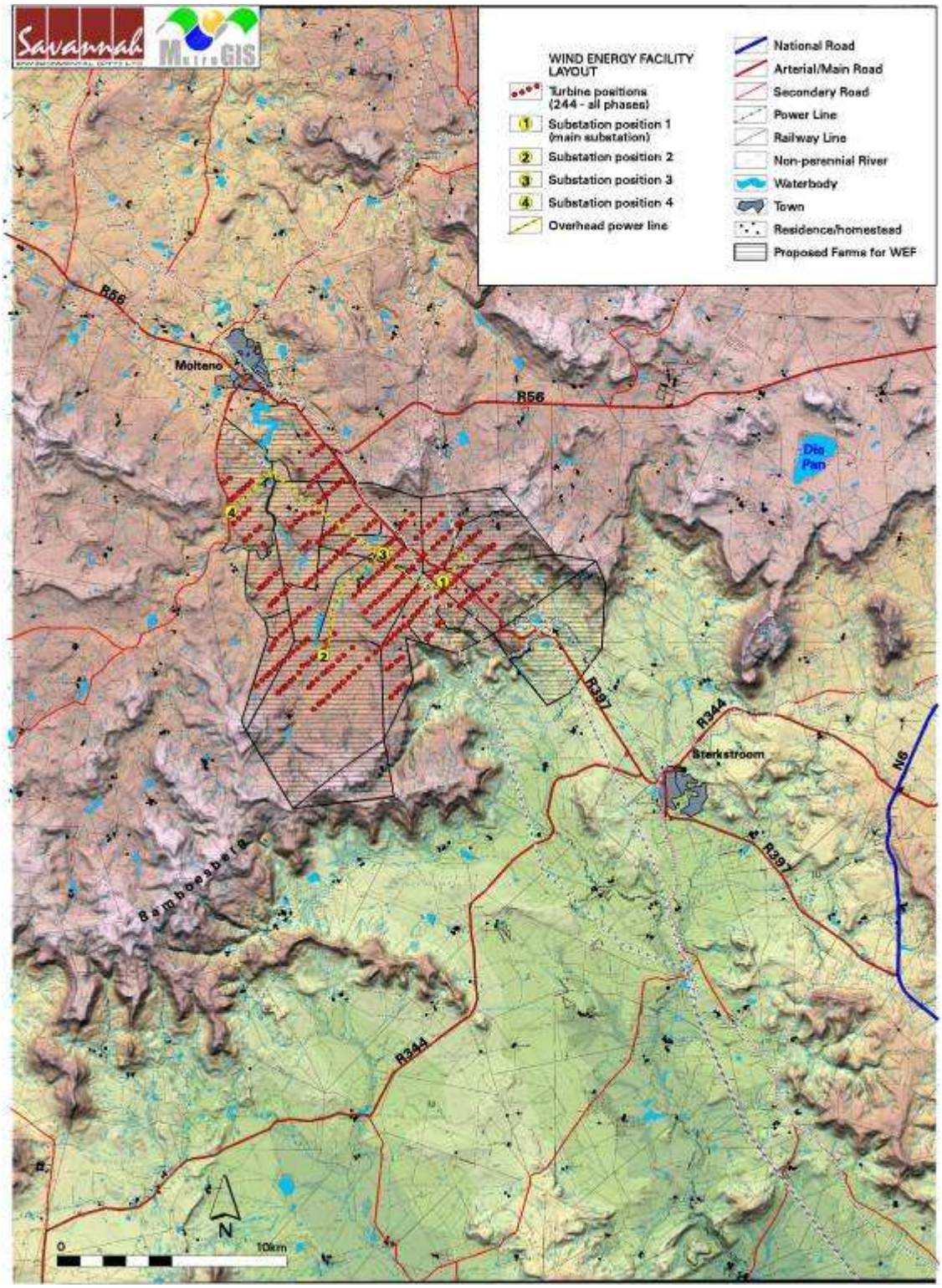



**Figure 7.1:** Locality map showing provisional wind turbine layout, power line corridors and proposed substation sites

The proposed site has been identified by Rainmaker Energy Projects based upon a number of criteria set by significant preceding feasibility studies for wind projects in the Northern Cape, Western Cape, Kwazulu-Natal, and Eastern Cape. The proposed project area is located 1.8 km south east of the town of Molteno, and

11 km north-west of Sterkstroom. The study area straddles the R56 and R397 (for a distance of approximately 14 km) that links Molteno to Dordrecht and the R397 that links Molteno to Sterkstroom and eventually the N6, within the Inkwanca Local Municipality of the Eastern Cape.

The environmental impact assessment (EIA) for the proposed Dorper 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 Dorper 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.

## 7.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices G - N 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 Final 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.

» Overall the proposed wind energy facility is likely to have a **medium** local and regional negative impact on the **ecology** on site, prior to mitigation. This could be reduced to **medium** - **low** 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 direct, long-term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. during the construction phase.

» 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 impact on avifauna is potentially of **medium - high** significance, but could be reduced to a **medium - low significance** with the implementation of mitigation measures. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined, from pre-construction and into the operational phase of the project. Refer to EMP (Appendix O) for an outline of the proposed bird monitoring programme.

» The findings of the **geology and soils** study indicate the most important impacts on geology and soils include soil degradation (including erosion). The significance of the main direct impacts that have been identified is considered **low to moderate** due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. A basic assessment of the potential geotechnical constraints on the project indicates no insurmountable problems which have may have an impact on the design and construction processes.

» The results of the **heritage** survey suggest that the impacts associated with turbine and other infrastructure footprints would have a **low impact** on the archaeological material in the study area. There is also the potential for impacts on fossil resources as the area is fossil-rich, this impact is potentially of **high 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. Potential visual impacts are of **high significance** (i.e. the facility will be highly visible) within 5km from the turbines. Homesteads and settlements 5km to 10km from the development may experience **low to moderate** visual impacts. The towns of Molteno and Sterkstroom are not expected to experience a significant visual impact. The visual impact of the core facility (mainly the wind turbines) is not readily mitigated due to the size of the structures in the landscape.

» 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 **high significance** on five of the identified sensitive receptors, 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

### *1. Visual impacts on the natural scenic resources of the region imposed by the components of the facility*

The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the natural scenic resources and rural character of this region imposed by the components of the facility. The rural and relatively unspoiled wide-open vistas surrounding the wind energy facility will be transformed for the entire operational lifespan (approximately 30 years) of the plant.

The visual impact assessment indicates a core area of potentially high visual impact within a 5km radius of the proposed wind energy facility on the upper escarpment of the valley within which the proposed facility is situated. Isolated pockets with a ranking of very high visual impact also occur within the 5km radius of the facility, including a band of approximately 1km in width running along the R397 (where it traverses the development site) as well as a band along Aitchison Road extension. Certain farm settlements within a 5km radius of the development can expect to be visually influenced (i.e. experience a potentially high visual impact). Homesteads and settlements within or close to a 5km radius of the development may also experience moderate to high visual impacts. Major roads that may fall within areas of potentially high visual impact include a section of the R397 running through the development site, as well as the section of the

R56 within 5 km of the site. Parts of the R344 and R397 south-east of the proposed wind energy facility, where partial views of the facility are expected, and sections of the R56 (north of the development area), fall within an area rated as having a potentially moderate to high visual impact.

Homesteads and settlements 5km to 10km from the development may experience low to moderate visual impacts. Roads traversing mountainous terrain and the extended valley to both the north-west and south-east of the facility may afford observers a clear, yet long distance (beyond 10km), view of the proposed development and may also constitute low to moderate visual impact.

The towns of Molteno and Sterkstroom (built-up areas with existing structures and visual clutter) are not expected to experience a significant visual impact from the proposed development. The development would have a low visual impact on Sterkstroom, and residents of Molteno would only have partial views of the wind energy facility, constituting a moderate potential visual impact.

The visual impact on the towns, settlements and farmsteads located within a 10-20km radius of the facility is expected to be low to negligible.

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.

Photo simulations were undertaken in order to illustrate the potential visual impact of the facility within the receiving environment (refer Appendix J for the remainder of the photo simulations).

**Figure 7.2** Enlarged view west from within the site along the R397 as it runs through the proposed wind energy facility

***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 ~132 km$^2$ was considered for the facility. The bulk of this effective 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 244 proposed turbine footprints (244 foundation areas of 20 m x 20 m in extent), laydown areas for turbines left in situ after construction to provide for on-going maintenance and repairs (244 laydown areas of 25 m x 50 m), access roads (to be rehabilitated to 3 m in width), four substations footprint (up to 150 m x 250 m in extent) and a workshop area (~150 m$^2$). The area of permanent disturbance is calculated as follows:

| **Facility component - permanent** | **Approximate area/extent (in m$^2$)** |
|---|---|
| 244 turbine footprints (each 20 m x 20 m) | 97 600 |
| 244 permanent laydown areas (each 25 m x 50 m) | 305 000 |
| ~ 90 km of permanent access roads (3 m in width) | 270 000 |
| Substation footprints (4 x 150 m x 250 m) | 150 000 |
| Workshop area | 150 |

| | |
|---|---|
| ~ 7 km of power lines - tower footprint & access road for power lines (4 m) | 28 000 |
| **TOTAL** | **850 750**<br>(of a total area of ~132 000 000)<br>**= 0.6 % of site** |

Temporarily affected areas comprise the interim construction facilities (batching plant, civil/electrical storage, site offices, parking of approximately 5 000 $m^2$), temporary laydown area as well as 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 5 m in width). The area of temporary disturbance is as follows:

| **Facility component - temporary** | **Approximate area/extent (in $m^2$)** |
|---|---|
| Interim construction facilities | 5 000 |
| Temporary laydown /storage area | 8 000 |
| Temporary crane travel (5 m) track adjacent to access road (6m in width) ~90km PLUS trench for cabling | 990 000 |
| **TOTAL** | **1 003 000**<br>(of a total area of 132 000 000)<br>**= 0.8 % of site** |

Therefore, a total area of 1 853 750 $m^2$ (i.e. approximately 185 ha) can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to 1.4 % of the total 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.

Figure 7.3 shows the combined sensitivity map for the project study area. Indicated on the map are:

» High sensitivity ecological areas
» High sensitivity heritage areas
» High sensitivity avifauna areas
» 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 footprint occupied by the infrastructure is limited (access roads having the biggest surface area of disturbance), and that should mitigation measures be adhered to, impacts can be

adequately managed. The primary reason for the high significance score is the fact that the impact will definitely occur, i.e. clearing of vegetation will have to take place, and the impact will be permanent. If the mitigation measures proposed in the ecological EIA study are implemented it will reduce impacts in these areas to an acceptable medium significance.

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most significant impact. However, the real extent of this potential risk is not currently well understood within the South African context.

The birds of greatest potential relevance and importance in terms of the possible impacts of the proposed wind energy facility are likely to be: (i) erratic incursions and/or seasonal influxes of non-breeding Cape Vulture, drawn down from the escarpment to feed on stock losses, (ii) flocks or breeding pairs of Blue Crane, Denham's Bustard and Blue Korhaan, and possibly seasonal influxes of Grey-crowned Crane and Ludwig's Bustard, (iii) a range of locally resident or visiting raptors (including African Grass Owl, Cape Eagle, African Marsh Harrier, Black Harrier, Verreaux's Eagle, Martial Eagle, Secretarybird, Lesser Kestrel and Lanner Falcon) foraging in or moving through the area, (iv) a suite of restricted range endemic passerines, including Drakensberg Rock-jumper, Bush Blackcap, Melodius Lark and Yellow-breasted Pipit, and (v) flocks or individuals of large wetland species commuting between resource areas (especially in relation to the Molteno Dam, including Black Stork.

The proposed facility is likely to have a significant, long-term impact on the avifauna of the area, and may have a negative effect on key rare, Red-listed and/or endemic species. The most obvious and immediate negative impacts are likely to be on Cape Vulture and other soaring raptors, bustards species and crane species. These birds may be disturbed by construction of the facility, may lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (cranes), or may suffer mortalities in collisions with the turbine blades and power lines (vultures and cranes). These effects, which may also impact on other priority species, 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.

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.

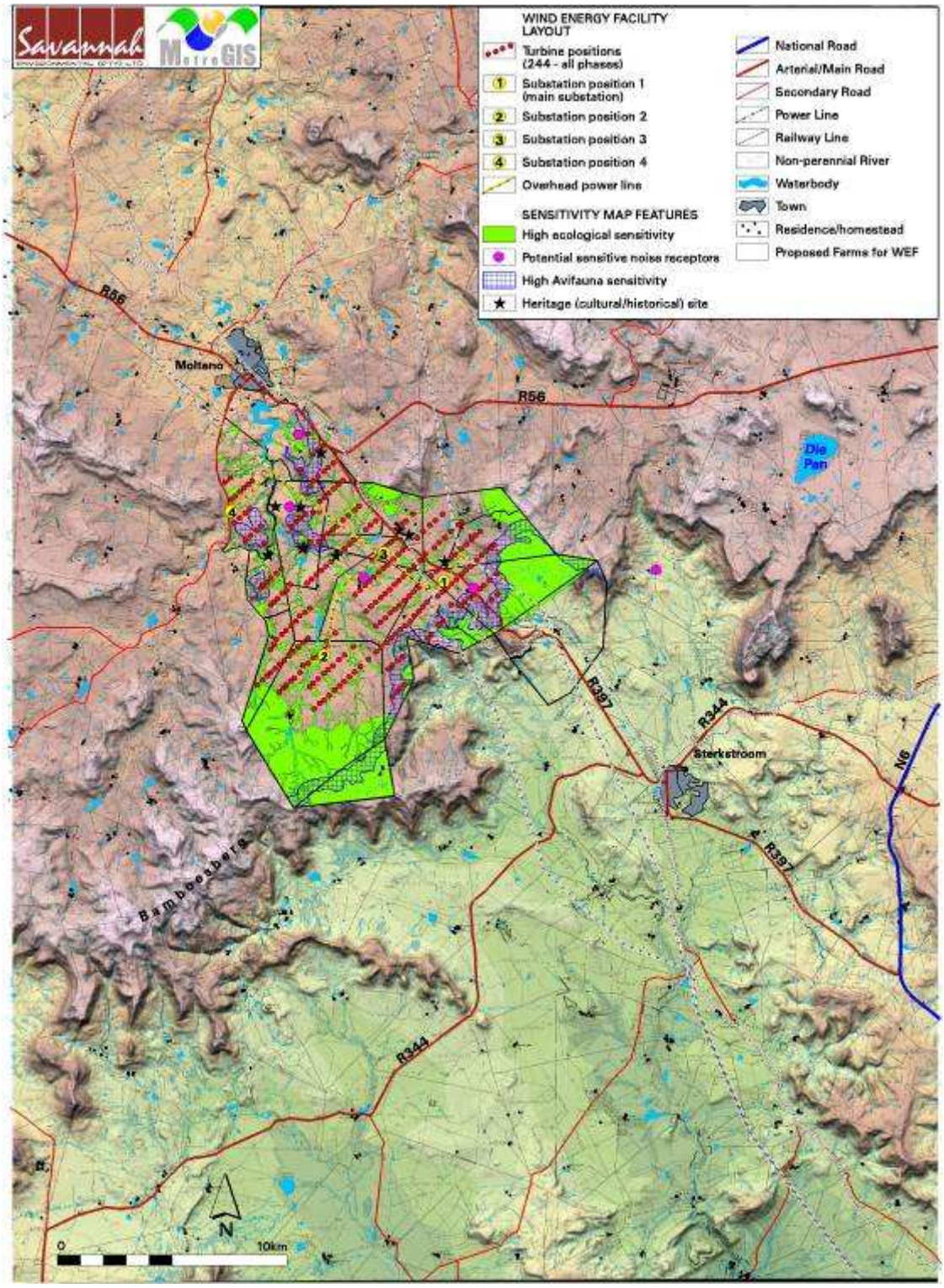



**Figure 7.3:** Combined sensitivity map for the project study area illustrating identified potentially sensitive areas in relation to the wind energy facility layout

It is also 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.

In order to reduce/avoid impacts on sensitive areas, it is suggested that:

» As far as possible, wind turbines and associated laydown areas and access roads which could potentially impact on sensitive areas should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not technically feasible or viable, alternative mitigation measures as detailed in this report must be implemented.
» 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 cable alignments should coincide as much as possible.
» A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area be implemented to cover the pre-construction environment as well as the operational phase of the project (Appendix H and Appendix O).
» High sensitivity avifaunal areas (as identified in Figure 7.1) require further monitoring during all four seasons to provide more certainty regarding bird movements within these areas if turbines are to be established there. This comprehensive monitoring should take place before development occurs within these areas (all other areas would only require bird monitoring once the facility is operational).
» The developer must consider the mitigation measures proposed in the heritage EIA assessment (Appendix K). 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 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.
» A qualified palaeontologist must be commissioned to carry out a field scoping study of the entire study area before construction commences in order to identify any areas within the development footprint where specialist

palaeontological mitigation during the construction phase might be required. Mitigation would involve the recording and judicious collection of fossil material and associated geological data. Should substantial fossils (such as vertebrate remains or any sort or plant-rich beds) be exposed at any time during construction, these should be safeguarded in situ, where feasible, and then appropriately removed by SAHRA or a professional palaeontologist.

» The workshop area, interim construction facilities and temporary laydown area should located away from any identified sensitive areas.

» The developer must consider the various mitigation options as suggested in the noise EIA assessment (Appendix M) to reduce the significance of the potential noise impact on any sensitive receptors to an impact of lower significance.

**3. *Impacts associated with the access roads, substations and power lines***

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 are up to 92 km of internal access roads proposed across the development footprint, however much of these will make use of existing access roads, so the length of new access roads would in reality be considerably less of this. 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.

Up to four substations will be constructed within the site footprint. Each wind turbine will be connected to one of the four proposed substations by underground electrical cables (33 kV cables). 132 kV distribution power lines are proposed to connect the substations in the facility to the existing transmission line traversing the site. The overhead power lines linking the facility with the various substations, 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.

Other impacts associated with the substation and power lines have been identified as being of low significance.

**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.

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.

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 phase 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. This amounts to ~4% (1667 MW) of the total estimated electricity demand (41 539 MW) by 2013.

Through pre-feasibility assessments and research, the viability of establishing a 244-turbine wind energy facility on a site between Molteno and Sterkstroom has been established by Dorper Wind Farm. 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.
» 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 proposed substation positions and power line corridors are considered to be acceptable from an environmental perspective.

## 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 Dorper Wind Energy Facility on a site near Molteno 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 5 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 **244 wind turbine units**, and all **associated infrastructure** (access roads to site, internal access roads, workshop building)
» Construction of up to **four 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 power lines traversing the site as proposed in Figure 7.1.

The following conditions would be required to be included within an authorisation issued for the project:

» Mitigation measures detailed within this report and the specialist reports contained within Appendices F to N 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.

- A monitoring program should be initiated in order to collect data on the numbers of birds affected by the wind energy facility. Comprehensive monitoring during all four seasons should take place prior to development occurring within the high sensitivity avifaunal areas identified in Figure 7.1.
- A monitoring programme should be implemented to document the effect on bats.
- The developer should consider the various mitigation options as proposed in the noise assessment to reduce the significance of the potential noise impact on any sensitive receptors.
- A qualified palaeontologist should be commissioned to carry out a field scoping study of the entire study area before construction commences.
- Applications for all other relevant and required permits required to be obtained by Dorper Wind Farm 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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