ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT SCOPING REPORT

PROPOSED KAROO RENEWABLE ENERGY FACILITY

NORTHERN AND WESTERN CAPE PROVINCE
(DEA Ref No: 12/12/20/1993)

DRAFT SCOPING REPORT
NOVEMBER 2010

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PROJECT DETAILS

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Draft Scoping Report: Proposed Karoo Renewable Energy Facility

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PURPOSE OF THE DRAFT SCOPING REPORT

South African Renewable Green Energy (SARGE) is proposing the establishment of a commercial electricity generating facility which will comprise a combination of a wind energy facility component and a photovoltaic solar facility component, as well as the associated infrastructure. The proposed facility is proposed to be established on an identified site located approximately 34 km south of Victoria West, falling within both the Northern and Western Cape Provinces (i.e. within the Ubuntu as well as the Beaufort West Local Municipalities). The facility will be referred to in this report as the Karoo Renewable Energy Facility. SARGE (Pty) Ltd has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Draft Scoping Report represents the outcome of the Scoping Phase of the EIA process and contains the following sections:

» **Chapter 1** provides background to the project and the environmental impact assessment
» **Chapter 2** provides an overview of the project, describes wind and solar energy as power options, provides insight to technologies and describes the activities associated with the project (project scope)
» **Chapter 3** outlines the process followed during the Scoping phase of the project
» **Chapter 4** describes the existing biophysical and socio-economic environment
» **Chapter 5** provides an evaluation of the potential issues associated with the proposed project
» **Chapter 6** presents the conclusions of the scoping study
» **Chapter 7** describes the Plan of Study for EIA
» **Chapter 8** contains a list references for the scoping report and specialist reports

The Scoping Phase of the EIA process identifies potential issues associated with the proposed project, and defines the extent of the studies required within the EIA Phase. The EIA Phase will address 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 release of a draft Scoping Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final Scoping Report will incorporate

all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

PUBLIC REVIEW OF THE DRAFT SCOPING REPORT

The Draft Scoping Report has been made available for public review at the following public places in the project area from **16 November 2010 to 15 December 2010**:

» Victoria West Library, Kerk Street, Victoria West
» Karoo Vleisboere Cooperation, Victoria West

The report is also available on:
» www.savannahSA.com

Please submit your comments to
Ingrid Snyman of Batho Earth PO Box 35130, Menlo Park, 0102 Tel: 082 779 2750 Fax: 088 012 361 1623 E-mail: ingrid@bathoearth.co.za
The due date for comments on the Draft Scoping Report is **15 December 2010**

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

SUMMARY

Background and Project Overview

South African Renewable Green Energy (SARGE) is proposing the establishment of a commercial electricity generating facility which will comprise a combination of a wind energy facility component and a photovoltaic solar facility component, as well as the associated infrastructure. The proposed facility is proposed to be established on an identified site located approximately 34 km south of Victoria West, falling within both the Northern and Western Cape Provinces (i.e. within the Ubuntu as well as the Beaufort West Local Municipalities).

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

The proposed Karoo Renewable Energy Facility is proposed on portions of the following farms: Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, Rietkloofplaaten 239, Modderfontein 228 and PhaisantKraal 1.

The proposed facility will have a **generating capacity of up to 350 MW** and will comprise of the following infrastructure:

- up to **150 wind turbines** with a generating capacity of up to 300MW
- an array of **photovoltaic (PV) panels** with a generating capacity of up to 50MW.

Other **infrastructure** associated with the facility will include:

- An **on-site generator transformer** and a **small substation** to facilitate the connection between the renewable energy facility and the Eskom electricity grid;
- **Foundations** to support both the turbine towers as well as the PV panels;
- **Cabling** between the project components, to be lain underground where practical;
- An **overhead power line** (132kV) of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (also known as the Biesiespoort) Substation;
- **Internal access roads**; and
- A **workshop area** for maintenance and storage.

Environmental Impact Assessment

The Scoping Phase for the Karoo Renewable 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). This **Draft Scoping Report** aimed to identify and describe potential environmental impacts associated with the proposed project and to define the extent of the specialist studies required within the EIA process. 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 (including relevant government authorities) and interested and affected parties (I&APs).

Evaluation of the Proposed Project

The Karoo Renewable Energy Facility is proposed to accommodate up to 150 wind turbines and an array of photovoltaic (PV) panels. The performance of the turbines is determined by disturbances to the wind resource, which requires that they are appropriately spaced. Detailed and reliable information about the strength and direction of the incoming solar radiation (i.e. the solar resource) is vital when considering the installation of a solar energy facility, as the solar resource is a critical factor to the success of the installation. The site that has been identified for the proposed renewable energy facility covers an area of approximately 200 km^2 which is larger than the proposed development footprint of the facility. Therefore, the facility and the associated infrastructure (including wind turbines, solar PV panels, substation, internal access roads, generator transformer and workshop area) can be appropriately placed within the larger site taking into account identified environmental constraints. This scoping study has identified areas of potential higher sensitivity on the larger site to assist in focusing the location of the development footprint to minimise the potential for environmental impact.

Issues identified through this scoping study as being potentially associated with the proposed facility include impacts on biodiversity and ecology, including habitat alteration and disturbance of fauna and flora during the operational phase due to regular maintenance activities, visual impacts, potential impacts on heritage sites, soil erosion, noise produced by the spinning of rotor blades; avian mortality resulting from collisions with turbine blades, solar panels and power lines and impacts on the social environment.

The majority of potential impacts identified to be associated with the construction and operation of the proposed facility are anticipated to be localised and restricted to the proposed site. No environmental fatal flaws were identified to be associated with the site, and no absolute 'no-go' areas were identified for the larger 200 km^2 site. A number of potentially sensitive natural habitats, areas important for

maintaining ecological processes as well as areas that might contain potentially sensitive noise receptors have been identified through the environmental scoping study, however, these will be assessed in detail in the EIA phase.

The potentially significant issues related to the **construction** of the Karoo Renewable Energy facility include, *inter alia*:

» Impacts on endangered flora, terrestrial fauna, and avifauna (local and site specific)
» Soil erosion, loss or degradation
» Loss of heritage resources
» Socio-economic impacts, including both positive and negative (job creation and business opportunities, impacts associated with construction workers in the area)
» Noise emanating from construction activities.

The potentially significant issues related to the **operation** of the combined wind and solar energy facility include, *inter alia*:

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads
» Bird mortality
» Positive socio-economic impacts
» Possible noise impacts on sensitive receptors
» Soil erosion, loss or degradation

Understanding which area of the site would be least impacted by the development of such a facility, SARGE should prepare the detailed infrastructure layouts for consideration within the EIA phase. Through the EIA phase more detailed studies will be conducted, and further sensitive areas will be marked, more accurately and in more detail than in this Draft Scoping Report.

In order to connect the renewable energy facility to the power grid, an overhead power line of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (Biesiespoort) Substation situated on the farm Nobelsfontein 227, will be required to be established. Potential issues identified to be associated with the proposed overhead distribution power line include impacts on flora, fauna and ecological processes, visual impacts, impacts on avifauna as a result of collisions and electrocutions, and potential impacts on heritage sites.

The power line will be considered in detail within the EIA phase in order to assess potential impacts associated with the power line corridor and make recommendations regarding a preferred alternative alignment and appropriate mitigation measures.

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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/)

Betz Limit: 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

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 prior to 1800

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/)

Photovoltaic cell: Semiconductors which absorb solar radiation to produce electricity

Photovoltaic effect: Electricity can be generated through the use of photovoltaic panels (semiconductors) which are comprised of individual photovoltaic cells that absorb solar energy to produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

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).

Renewable energy feed-in tariff (REFIT): REFITs are used to promote renewable energy and have been adopted in over 36 countries worldwide. The establishment of the REFIT in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector, and to promote competitiveness between renewable and conventional energies in the medium and long-term. Under the National Energy Regulator Act

(Act No. 40 of 2004), the Electricity Regulation Act (Act No. 4 of 2006), and all subsequent relevant amendment acts, the National Energy Regulator of South Africa (NERSA) has the mandate to determine the prices at and conditions under which electricity must be supplied by licence.

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 between 80 and 125 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 125 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
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DEA	National Department of Environmental Affairs
DEADP	Department of Environmental Affairs and Development Planning
DENC	Department of Environment and Nature Conservation
DME	Department of Minerals and Energy
DoE	Department of Energy
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GHG	Green House Gases
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
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)
PV	PhotoVoltaic
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

INTRODUCTION CHAPTER 1

South African Renewable Green Energy (SARGE) is proposing the establishment of a commercial electricity generating facility which will comprise a combination of a wind energy facility component and a photovoltaic solar facility component, as well as the associated infrastructure. The proposed facility is proposed to be established on an identified site located approximately 34 km south of Victoria West, falling within both the Northern and Western Cape Provinces (i.e. within the Ubuntu as well as the Beaufort West Local Municipalities). The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Draft Scoping Report.

1.1. Summary of the Proposed Development

The proposed Karoo Renewable Energy Facility is proposed on portions of the following farms: Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, Rietkloofplaaten 239, Modderfontein 228 and PhaisantKraal 1. The total area for consideration within which the proposed facility will be constructed is approximately 20 222 ha (202 km^2) in extent (refer to Figure 1.1).

The renewable energy facility is proposed to accommodate up to 350 MW which would comprise a combination of the following technologies:

» up to **150 wind turbines** with a generating capacity of up to 300MW
» an array of **photovoltaic (PV) panels** with a generating capacity of up to 50MW

Other **infrastructure** associated with the facility will include:

» An on-site generator transformer and a small substation to facilitate the connection between the renewable energy facility and the Eskom electricity grid;
» Foundations to support both the turbine towers as well as the PV panels;
» Cabling between the project components, to be lain underground where practical;
» An overhead power line (132kV) of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (also known as the Biesiespoort) Substation; and
» Internal access roads; and
» Workshop area for maintenance and storage.

The overall aim of the design and layout of the facility is to maximise electricity production through **exposure to the wind resource and solar radiation**, while minimising infrastructure, operation and maintenance costs, and **social and environmental impacts**. In order to meet these objectives local level environmental

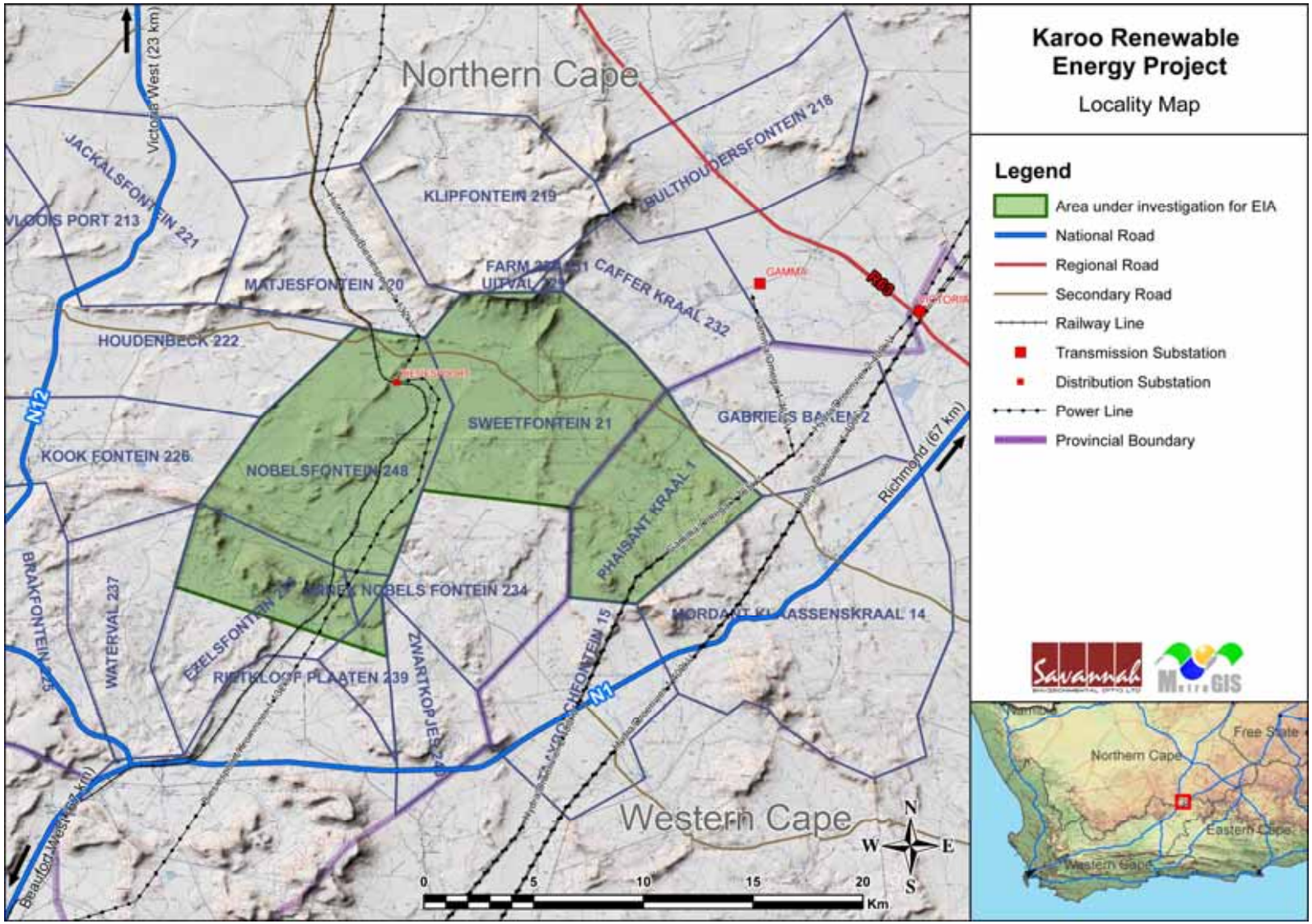

Figure 1.1: The proposed location for the Karoo Renewable Energy Facility

and planning issues are assessed through site-specific studies in order to delineate areas of sensitivity within the broader site, and serve to inform the development footprint for the facility. The use of wind- and solar energy for power generation can be described as a non-consumptive use of natural resources which emits zero greenhouse gas emissions. The generation of renewable energy contributes to South Africa's electricity generating market which has been dominated by coal-based power generation.

The scope of the proposed Karoo Renewable Energy Facility, including details of all elements of the project (for the design/planning, construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.2. Rationale for the proposed Karoo Renewable Energy Facility

The primary motivation behind the development of the proposed renewable energy facility is the contribution towards the establishment of the renewable energy sector as well as the contribution of electricity supply towards the national grid. South Africa's electricity supply remains heavily dominated by coal-based power generation and has an extremely low market share of renewable energy generation. To date, South Africa has failed to exploit the various gains which the renewable energy industry offers, and the country's significant renewable energy potential remains largely untouched.

1.2.1. Renewable Generation Targets

Renewable Energy is internationally recognised as a major contributor in protecting our climate, our natural resources and the environment as well as providing a wide range of environmental, economic and social benefits that will contribute towards long-term global sustainability. This is a rapidly growing international sector whose overall capacity increased to 280 GW in 2008, a 75 % increase from 160 GW in 2004, excluding large hydropower. Grid connected renewable energy is currently the fastest growing sector in the global energy market

Targets for the promotion of renewable energy exist in more than 58 countries, of which 13 are developing countries. The South African government has recognised the country's high potential for developing its renewable energy sector and, coupled with the prevalent electricity shortages, the need to develop supplementary, environmentally friendly and sustainable sources of energy was identified. The development of renewable energy in South Africa is supported by a policy framework provided by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to the final energy consumption by 2013. This amount to approximately 4% or 1 667 MW of the total estimated electricity demand which amounts to 41 539 MW by 2013 (NERSA, 2009). This target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro.

The Department of Energy's (previously known as the Department of Minerals and Energy) macroeconomic study of renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy Project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. Additionally, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per Terra Watt hour (TWh) (South Africa Renewable Energy Feed-in Tariff (REFIT) Regulatory Guideline published by NERSA (March 2009)).

1.3. Requirement for an Environmental Impact Assessment Process

The proposed renewable energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of NEMA. This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority, while the Northern Cape Department of Environment and Nature Conservation (DENC) as well as the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) are the commenting authorities. An application for authorisation has been accepted by DEA under application reference number **12/12/20/1993**.

The need to comply with the requirements of the EIA Regulations ensures that the competent authority is provided with the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. SARGE appointed Savannah Environmental as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA process for the proposed project.

An EIA is also an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental

issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with interested and affected parties (I&APs).

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27 – 36) and R387, both Scoping and EIA processes are required as the proposed project includes the following "listed activities" in terms of GN R386 and R387 (GG No 28753 of 21 April 2006).

Relevant Notice	Activity No	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 hectare
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 R386 (21 April 2006)	1(m)	The construction of facilities or infrastructure, including associated structures or infrastructure, for 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 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)	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 cubic metres but less than 1 000 cubic metres at any one location or site.
Government Notice R386 (21 April 2006)	12	The transformation or removal of indigenous vegetation of 3 hectares 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)	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.

Relevant Notice	Activity No	Description of listed activity
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 4 m or that has a reserve wider than 6 m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.
Government Notice R386 (21 April 2006)	16(b)	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 hectare.
Government Notice R386 (21 April 2006)	17	Phased activities where any one phase of the activity may be below a threshold specified in this schedule but where a combination of the phases, including expansions and extensions, will exceed a specified threshold.

This Draft Scoping Report documents the evaluation of the potential environmental impacts of the proposed renewable energy facility and forms part of the EIA process. The Scoping Phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

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

Savannah Environmental was contracted by SARGE (Pty) Ltd as the independent EAP to undertake both Scoping and EIA processes for the proposed renewable energy facility. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to SARGE. 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 holistic environmental management services, including environmental impact assessments 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 team at Savannah Environmental have gained substantial experience in undertaking environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation. They have successfully managed and undertaken EIA processes for wind and solar energy facilities, 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 associated with the proposed project, Savannah Environmental has appointed several specialist sub-consultants to conduct specialist impact assessments. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

OVERVIEW OF THE PROPOSED PROJECT CHAPTER 2

The following chapter provides an overview of the proposed renewable energy facility that is envisaged to be established on a site, south of Victoria West in the Northern and Western Cape Provinces. The project scope includes the planning /design; construction; operation and decommissioning activities. This chapter also explores site and technology alternatives as well as a "do nothing" option. Lastly, it explores both wind and solar energy facilities as a means for power generation.

The renewable energy facility is proposed to be established on portions of the following farms:

» Nobelsfontein 227
» Annex Nobelsfontein 234
» Ezelsfontein 235
» Rietkloofplaaten 239
» Modderfontein 228 and
» PhaisantKraal 1

The proposed site is located approximately 34 km south of Victoria West, in the Northern and Western Cape Provinces, within the Ubuntu as well as the Beaufort West Local Municipalities. The larger site covers an approximate area of 20 222 ha (200 km^2). The combined renewable energy facility, which will be appropriately placed on the larger site, will include the following infrastructure:

» up to **150 wind turbines** with a generating capacity of up to 300MW
» an array of **photovoltaic (PV) panels** with a generating capacity of up to 50MW
» An **on-site generator transformer** and **substation** to facilitate the connection between the renewable energy facility and the Eskom electricity grid;
» **Foundations** to support both the turbine towers as well as the PV panels;
» **Cabling** between the project components, to be lain underground where practical;
» An overhead power line (132kV) of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (Biesiespoort) Substation; and
» **Internal access roads**; and
» Workshop area for maintenance and storage.

2.1. Site Alternatives

No site alternatives are proposed for this project as the placement of a renewable energy facility is strongly dependent on several factors including climatic conditions, topography, orography, the extent of the site, accessibility of the site, connection to the Eskom

electricity grid, etc. The proposed site has been identified by SARGE as being highly desirable for a renewable energy facility in terms of the following characteristics:

» **Topography:** the area proposed for the construction of the wind energy facility component is exposed to the wind resource as it is situated on elevated terrain. Areas that are associated with level/even topography are preferred for the installation of the photovoltaic solar facility component as the PV panels require a flat surface to be constructed upon.
» **Climatic conditions:** The economic viability of a renewable energy facility is directly dependent on the climatic conditions of the area. The site identified for the establishment of the facility receives sufficient average daily direct radiation as well as exposure to the wind resource to motivate for the establishment of such a combined facility.
» **Extent of site:** The proposed site which covers an area of approximately 200 km^2 will allow for the installation of both the wind energy facility component as well as the photovoltaic solar facility component, including associated infrastructure as the extent of the site is larger than the development footprint required for the facility.
» **Power transmission considerations:** an overhead power line (132kV) of ~6km in length is proposed to connect the facility to Eskom's existing Skietkuil/Biesiespoort Substation.
» **Site access**: on a regional scale the N1 as well as the N12 national roads provide good access to the subject site. This will assist in the transportation of the facility components during the construction phase. A secondary road traverses the study site and also provides access to various parts of the study area. A number of less significant roads lead from this secondary road to various parts of the site.
» **Local labour and economic stimulus:** the site is located in close proximity to Victoria West which will act as a ready source of local labour during construction of the proposed facility.

Based on these considerations, SARGE considers the identified site as highly preferred in terms of the development of the proposed renewable energy facility.

2.1.1. Layout Design Alternatives

The proposed facility is expected to have a development footprint which is smaller than the identified site, and will be determined at a later stage (and considered in the EIA Phase). The facility and its associated infrastructure (i.e. power line and internal roads etc) can be suitably located within the broader site.
During the Scoping Phase, site-specific specialist studies are used to identify potentially environmental sensitive areas (which should be avoided by the proposed development as far as possible) for consideration in detail during the EIA phase. The information from these studies will be used to inform layout alternatives for the proposed development

site and inform recommendations regarding a preferred alternative. Specific design alternatives will include *inter alia* the layout of the PV panels and wind turbines, as well as alternative routes for the power line corridor and the access roads. The aim of this planning process is to avoid environmentally sensitive areas as far as possible.

2.1.2. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Karoo Renewable Energy Facility. Should this alternative be selected there will be no potential environmental impacts.

However, should the facility not be developed the benefits related to the generation of electricity from renewable energy resources will not be realised even though the generation of electricity from renewable energy resources offers a wide range of socio-economic and environmental benefits for South Africa. These benefits are explored in further detail in the South Africa REFIT Regulatory Guideline published by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. 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 major consumers 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, when compared with wet cooled conventional power stations; this translates into revenue savings 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 due to the detrimental effects of climate change on water availability.
» **Exploitation of our significant renewable energy resource:** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The releases of by-products through the burning of fossil fuels 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 and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas emissions. South Africa 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:** 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 have 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.

The 'do nothing' alternative will not assist the South African government in accomplishing their set targets for renewable energy. This is, therefore, not a preferred alternative and not assessed in further detail.

2.2. Renewable Energy Technologies

Various renewable energy technologies are available for electricity generation. SARGE proposes the establishment of a renewable energy facility which will ultimately comprise a combination of wind and solar energy technologies in order to generate electricity, which will be fed into the National power grid. Renewable energy technologies including wind turbines and solar panels offer an alternative to fossil fuels, thereby reducing the amount of CO_2 emissions into the atmosphere. It is proposed that this renewable energy facility will employ both wind turbines and photovoltaic (PV) panels. Both wind turbines and solar photovoltaic (PV) panels are described in more detail below.

2.2.1. Wind Energy as a Power Generation Technology

A wind energy facility consists of multiple wind turbines which are used to capture the kinetic energy of the wind. The mechanical power generated by the rotation of the blades is transmitted to the generator within the nacelle via a gearbox and a drive train. The wind turns the blades, which in turn spin a shaft which connects to a generator and generates electrical power. The use of wind for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuous operation. Wind power produces an insignificant amount of greenhouse gases during its entire

lifecycle and the operational phase does not produce carbon dioxide, sulfur dioxide, mercury, particulates, or any other type of air pollution, compared to fossil fuel power generation technologies including coal fired power stations.

Wind energy has the attractive characteristic that the fuel used to generate electricity is free. The economics of a wind energy project significantly 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.

A wind measurement and analysis programme is being conducted by SARGE as only measured data will provide a robust prediction of the expected energy production of the facility over its lifetime. The placement of a wind energy facility and the actual individual turbines must therefore consider the following technical factors:

» Predominant **wind direction and frequency**
» **Topographical features** or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)
» **Effect of adjacent turbines** on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

2.2.2. How do Wind Turbines function

Wind turbines are mounted on a tower to capture the kinetic energy of the wind which is used to turn a wind turbine to generate electricity. At 30 m or more above ground, turbines can take advantage of a typically faster and less turbulent wind resource. 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). The rotor and a nacelle are 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.

Wind turbines typically need to be spaced approximately 2 to 3xD apart, and 5 to 7xD where a turbine is behind another (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 turbine whose rotor is 90 m in diameter, each turbine would need to be separated by approximately 180 m to 270 m. The erection of turbines in parallel rows one behind another would require a distance between rows of 450 m to 630 m to avoid wake effects from one turbine onto another. Once a viable footprint has been determined the micro-siting of the turbines will be determined using industry standard software systems which will automatically consider the spacing requirements.

2.2.3. Main Components of a Wind Turbine

The turbine consists of the following major components (refer to Figure 2.1):

» The rotor
» The nacelle
» The tower

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.

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.

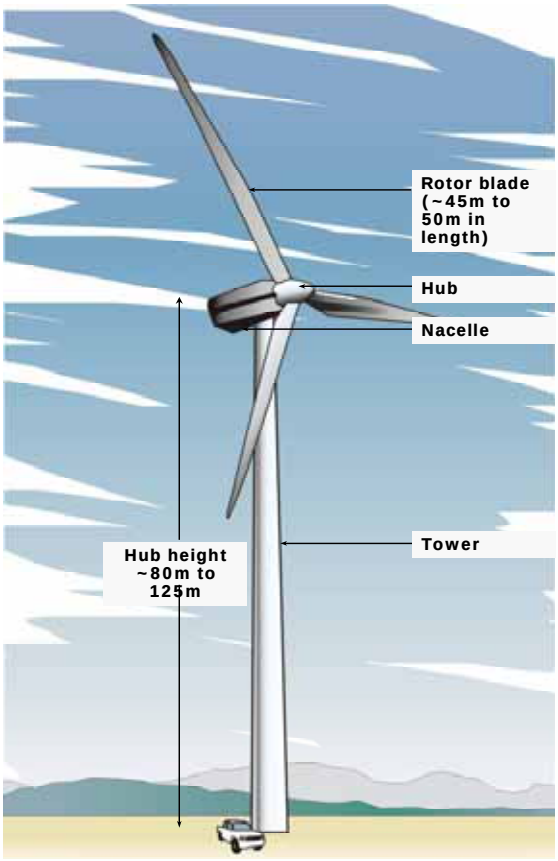

Figure 2.1: Illustration of the main components of a wind turbine.

The Tower

The tower, which supports the rotor, is constructed from tubular steel and is proposed to be between 80 and 125m 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.

2.2.4. Operating Characteristics of a Wind Turbine

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 stop entirely. In practice, the collection efficiency of a rotor is not as high as

59%; the 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 - 30% of the original energy available in the wind.

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. 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 and17 m/s).

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 10 and 15 km/hr (~3 m/s and 4 m/s). At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

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**. 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.

2.2.5. Solar Energy as a Power Generation Technology

Solar Power Plants uses the conversion of solar energy into a useful form such as electricity. The use of solar energy for electricity generation is also classified as a non-consumptive use of a natural resource and consumes no fuel for continuous operation.

Similar in nature to wind energy, solar energy also has the attractive attribute of a free fuel. Detailed and reliable information about the strength and direction of the incoming solar radiation (i.e. the solar resource) is vital when considering the installation of a solar energy facility, as the solar resource is a critical factor to the success of the installation.

Solar energy facilities produce an insignificant quantity of greenhouse gases over its lifecycle as compared to conventional coal-fired power stations. The operational phase of a solar facility does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as do fossil fuel power generation technologies.

2.2.6. How do Solar Photovoltaic Facilities function

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity. This is achieved through the use of the certain components.

2.2.7. Main Components of a Solar Photovoltaic (PV) Facility

The main components of a photovoltaic facility consist of the following major components:

» PV cells
» Support structure

PV Cells
An individual PV cell is made of silicone which acts as a semiconductor. The cell absorbs solar radiation which energises the electrons inside the cells and produces electricity. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. A single cell is sufficient to power a small device such as an emergency telephone, however to produce 50 MW of power, the proposed facility will require numerous cells arranged in multiples/arrays which will be fixed to a support structure (refer to Figure 2.2).

Support Structure
The PV panels will be fixed to a support structure which will allow for the PV panels to be set at an angle so to receive the maximum amount of solar radiation. The angle of the panels is dependent on the latitude of the proposed facility and may be adjusted to optimise for summer or winter solar radiation characteristics.

Figure 2.2: Typical PV cell and an array of PV panels.

2.3. Construction Phase of Facility

In order to construct the proposed renewable energy facility and associated infrastructure, a series of activities will need to be undertaken. The construction process is discussed in more detail below.

Conduct Surveys

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

Establishment of Access Roads to the Site

The broader site can be accessed via a secondary road leading off the National N1 and N12 routes. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). The road alignments will be informed by the final micro-siting/positioning of the PV panels and wind turbines, and other infrastructure.

Although the secondary access road is unlikely to have been subjected to vehicle numbers and loading of the same scale and intensity to that expected during construction of the facility, it is assumed for the purposes of this assessment that it will be mainly suitable for the construction related traffic in terms of load capability and durability. It is, however, more than likely that some access road upgrades will be required. The road bend radii must be amended to accommodate the bending radii needed to transport all wind turbine components and the transportation equipment used by the transport supplier. The extent of upgrade required will be assessed further during the EIA Phase. The final layout of the site specific access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each component. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The components and equipment required for the construction of the proposed renewable energy facility will be brought to site in sections by means of national and provincial roads and then dedicated access/haul road to the site itself. Some of the components (i.e. transformer, turbine tower etc.) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[1] by virtue of the dimensional limitations, particularly for wind turbine components (i.e. length and weight). During the

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

construction phase the existing road infrastructure may require alterations (e.g. widening on corners), and protection of road-related structures (i.e. bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading.

Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the establishment of the power line.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment which will be required on site. Hard standing areas will also need to be established for the operation of any cranes used on site.

Construct Power Block

An on-site generator transformer/small substation (the power block) will be required to facilitate the connection between the renewable energy facility and the Eskom electricity grid. The position of the power block within the footprint of the broader site will be informed by the final positioning of the facility components.

The construction of the power block would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure includes the overhead power line (±6 km in length) feeding into the Eskom electricity network at the existing Skietkuil (Biesiespoort) Substation. A workshop, storage areas as well as a contractor's equipment camp may also be required.

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.

Connect Substation to Power Grid

The overhead power line will be fed into the Eskom grid at the existing Skietkuil (also known as Biesiespoort) Substation which is located within the development footprint of the site.

Undertake Site Remediation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the

facility, any access points to the site which are not required during the operational phase must be closed and rehabilitated.

2.4. Operation Phase

The electricity that is generated from the PV panels and wind turbines will be stepped up through the on-site generator transformer. Thereafter the power will be evacuated from the substation through the overhead power line to feed into the Skietkuil (Biesiespoort) Substation.

It is anticipated that a full-time security, maintenance and control room staff will be required on site. Each component within the solar energy facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions or maintenance activities.

2.5. Decommissioning Phase

The renewable energy facility is expected to have a lifespan of approximately 30 years (with maintenance) and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. If economically feasible/desirable the decommissioning activities would comprise the disassembly and replacement of the individual components with more appropriate technology/ infrastructure available at that time. However, if not deemed so, then the facility would be completely decommissioned which would include the following decommissioning activities.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas, construction platform) and the mobilisation of decommissioning equipment.

Disassemble and Recycle Components

The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.

APPROACH TO UNDERTAKING THE SCOPING PHASE CHAPTER 3

An EIA refers to the process involving the identification and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two Phases: a **Scoping Phase** and an **EIA Phase**. The Scoping Phase culminates in the submission of a Final Scoping Report to the component authority, which in this case is the DEA, for review and acceptance before proceeding onto the EIA Phase of the process. The EIA Phase culminates in the submission of an EIA Report, including a draft Environmental Management Plan (EMP), to the competent authority for decisionmaking.

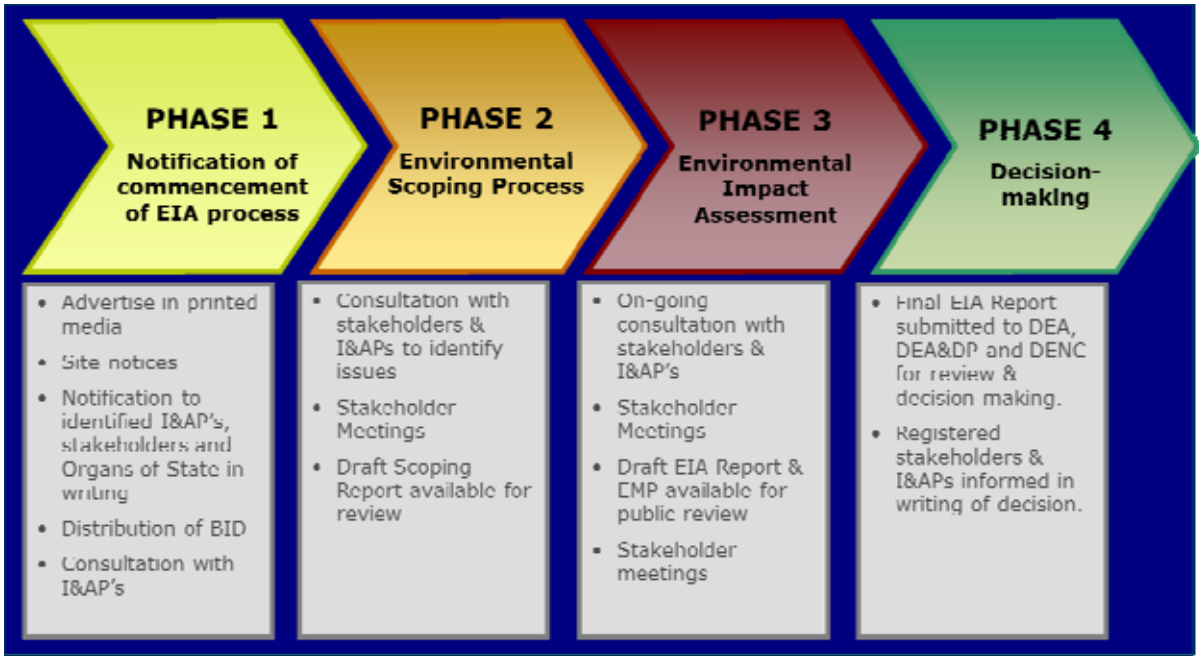

Figure 3.1: The four phases of an EIA Process

The Scoping Phase for the proposed renewable energy facility has been undertaken in accordance with the EIA Regulations published in GN 28753 (21 April 2006), in terms of Section 24(5) of NEMA. This Draft Scoping Report aimed to identify and briefly describe the receiving environment and the potential environmental impacts associated with the proposed project and to define the extent of the specialist studies required within the EIA Phase. 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 developer (SARGE), as well as a consultation process with key stakeholders (including relevant government authorities) and I&APs. This chapter serves to outline the process which was followed during the Scoping Phase.

3.1. Objectives of the Scoping Phase

The Scoping Phase aimed to:

» Describe the **baseline / affected environment** prior to development.
» **Identify** potential environmental/social impacts (both positive and negative) during the construction and operation phases of the proposed development, within the broader study area through a desktop review of existing baseline data and specialist studies.
» Make recommendations regarding more detailed studies required in the EIA phase of the process.
» Provide the authorities with **sufficient information** in order to make a decision regarding the scope of issues to be addressed in the EIA process, as well as regarding the scope and extent of specialist studies that will be required as part of the EIA Phase.

Within this context, the objectives of this Scoping Phase are to:

» Clarify the **scope** and **nature** of the proposed development.
» Clarify any reasonable and feasible projectspecific **alternatives** to be considered through the EIA process, including the 'nogo' option.
» Identify and evaluate key **environmental issues / impacts** associated with the proposed project and, through a process of broadbased consultation with I&APs and stakeholders and desktop specialist studies, identify those issues to be assessed in more detail in the EIA Phase of the EIA process.
» Conduct an open, participatory and transparent **public involvement process** and facilitate the inclusion of I&AP and stakeholder concerns regarding the proposed project in the decisionmaking process.

3.2. Regulatory and Legal Context

The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority which exercise control through both statutory and nonstatutory instruments – that is National, Provincial and Local levels.

As the development of both solar and wind energy projects are multisectoral, encompassing economic, spatial, biophysical, and cultural dimensions, various statutory bodies are likely to be involved in the approval process for the proposed facility.

3.2.1. Regulatory Hierarchy

At the national level, the main regulatory agencies include:

- *Department of Energy (formerly DME):* This department is responsible for policy relating to all energy forms, including renewable energy. Solar and wind energy are considered under the White Paper for Renewable Energy (2003) 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 renewable 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.
- *South African National Roads Agency (SANRAL):* This department is responsible for all National routes.
- *Civil Aviation Authority (CAA):* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
- *Department of Water affairs:* This department is responsible for effective and efficient water resources management to ensure sustainable economic and social development.

At the Provincial Level, the main regulatory agencies include:

- *The Northern Cape Department of Environment and Nature Conservation (DENC) and Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)* are the commenting authorities for this project as it falls within the Northern and Western Cape Provinces.
- *The Department of Transport and Public Works* in both the Northern and Western Cape Province is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- *Heritage Western Cape:* This body is responsible for all heritage related issues in the Western Cape Province.
- *Cape Nature*: This body has the statutory responsibility for biodiversity conservation in the Western Cape.
- *WESSA (Northern Cape):* is a membership-based environmental organization who is responsible for biodiversity related issues within the Northern Cape Province.

At the local level, the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. The local municipalities which were identified for the proposed project are the Ubuntu as well as

the Beaufort West Local Municipalities. The Beaufort West Local Municipality forms part of the Central Karoo District Municipality while the Ubuntu Local Municipality forms part of the Pixley ka Seme District Municipality.

3.2.2. Legislation and Guidelines that have informed the preparation of this Scoping Report

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

- National Environmental Management Act (Act No. 107 of 1998)
- EIA Regulations, published under Chapter 5 of the NEMA (GN R385, GN R386 and GN R387 in Government Gazette 28753 of 21 April 2006)
- 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)

Several other acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the Scoping Report and to be addressed in the EIA Phase. A listing of relevant legislation is provided in Table 3.1. A more detailed review of legislative requirements applicable to the proposed project will be included in the EIA Phase.

Table 3.1: Initial review of relevant policies, legislation, guidelines and standards applicable to the proposed renewable energy facility

Legislation	Applicable Sections
National Legislation	
Constitution of the Republic of South Africa (Act No 108 of 1996)	» Bill of Rights (S2) » Environmental Rights (S24) – i.e. the right to an environment which is not harmful to health and wellbeing » Rights to freedom of movement and residence (S22) » Property rights (S25) » Access to information (S32) » Right to just administrative action (S33) » Recognition of international agreements (S231)
National Environmental Management Act (Act No 107 of	» National environmental principles (S2), providing strategic environmental management

Legislation	Applicable Sections
1998)	goals and objectives of the government applicable throughout the Republic to the actions of all organs of state that may significantly affect the environment » NEMA EIA Regulations (GN R385, 386 & 387 of 21 April 2006) (published in terms of Chapter 5), with effect from 3 July 2006 » Public Participation (S2) » The requirement for potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority (S24 – Environmental Authorisations) » Duty of Care (S28) requiring that reasonable measures are taken to prevent pollution or degradation from occurring, continuing or recurring, or, where this is not possible, to minimise & rectify pollution or degradation of the environment » Procedures to be followed in the event of an emergency incident which may impact on the environment (S30) » Appeals against decisions made by authorities (S43)
Environment Conservation Act (Act No 73 of 1989)	» National Noise Control Regulations (GN R154 dated 10 January 1992)
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7) » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35) » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36) » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development (S38) » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44)
World Heritage Conservation Act	» Enforcement and implementation of the World

Legislation	Applicable Sections
(Act No 49 of 1999)	Heritage Convention in South Africa » Recognition and establishment of World Heritage Sites
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to list ecosystems which are threatened and in need of protection (S52) – none have as yet been published » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) none have as yet been published » A list of threatened & protected species has been published in terms of S 56(1) Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» National, provincial and local ambient air quality standards (S9 10 & S11) » Listed Activities (S21) » Atmospheric Emissions Licenses (S22) » Measures in respect of dust control (S32) – no regulations promulgated as yet » Measures to control noise (S34) no regulations promulgated as yet
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048)
National Water Act (Act No 36 of 1998)	» National Government is the public trustee of the Nation's water resources (S3) » Entitlement to use water (S4) – entitles a person to use water in or from a water resource for purposes such as reasonable domestic use, domestic gardening, animal watering, fire fighting and recreational use, as set out in Schedule 1 » Duty of Care to prevent and remedy the effects of pollution to water resources (S19) » Procedures to be followed in the event of an

Legislation	Applicable Sections
	emergency incident which may impact on a water resource (S20) » Definition of water use (S21) » Requirements for registration of water use (S26 and S34) » Definition of offences in terms of the Act (S151)
Water Services Act (Act No 108 of 1997)	» No person may dispose of industrial effluent except in a manner approved by the water services provider (S7)
Aviation Act (Act No 74 of 1962)	» 13th amendment of the Civil Aviation Regulations (CARs) 1997 » The Minister of Transport has under section 22(1) of the Aviation Act, 1962 made the regulations in the Schedule hereto. » Obstacle limitations and marking outside aerodrome or heliport CAR Part 139.01.33
Waste Act (Act No 59 of 2008)	» Waste management measures » Regulations and schedules (Schedule A & B) » Listed activities requiring waste licenses » Waste disposal practices (S20) » Contamination
National Forests Act (Act No 84 of 1998)	» Protected trees » Conservation of forests
Atmospheric Pollution Prevention Act (Act No 45 of 1965)	» Controlled areas (S8) » Dust control (S27)
National Parks Act (Act No 57 of 1976)	» Declaration of National Parks
National Environmental Protected Areas Act (Act No 57 of 2003)	» System of protected areas in South Africa (S9 – 16) » Regulation and prohibition of activities in Protected Areas (S37, 38 & 40)
National Roads Act (Act No 7 of 1998)	» Policy concerning use and management of national roads,
Guideline Documents	
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA No. 107 of 1998	» Prediction of impact that noise emanating from a proposed development would have on occupants of surrounding land by determining the rating level. » Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape Towards a Regional Methodology for Wind Energy Site	» Regional methodology for the siting of wind energy facilities within the Western Cape (Report 5) » Project level methodology for assessing wind energy facilities within the Western Cape

Legislation	Applicable Sections
Selection	(Report 6)
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	» Outlines 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
The White Paper on Renewable Energy (2003)	» National targets for renewable energy generation

3.3. Methodology for the Scoping Phase

The Scoping 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 scoping Phase are discussed in further detail below.

3.3.1 Authority Consultation and Application for Authorisation in terms of GN No R385 of 2006

As this is an energy generation project, National DEA is the competent authority (authorising body) for this application. As the proposed project falls within the boundaries of both the Northern and Western Cape Province, DENC and DEA&DP will act as the primary commenting authorities for the application. Consultation with both these authorities has been undertaken throughout the Scoping process and has included the following:

» Consultation with DEA regarding the proposed project and the Scoping/EIA process to be undertaken.
» Submission of an application for authorisation to DEA with a copy submitted to DENC and DEA&DP. This application was accepted and issued with the DEA reference number **12/12/20/1993**.

A record of all authority consultation is included within Appendix B.

3.3.2. Public Participation Process

The aim of the public participation process is primarily to ensure that information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs. Furthermore, participation by potential I&APs is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the application. And lastly, all comments received from stakeholders and I&APs are recorded, which serve to further direct the specialist studies and the EIA process.

Figure 3.2 illustrates some of the key steps in the public participation process. These are discussed further below:

Figure 3.2 Key steps of the Public Participation Process

» **Identification of I&APs and establishment of the I&AP Database**

Identification of I&APs was undertaken by **Batho Earth** (specialist public participation consultants) through existing contacts and databases, recording responses to site notices and newspaper advertisements as well as through the process of networking. The key stakeholder groups identified include:

* Provincial and local government departments (including DEA, DENC, DEA&DP, SAHRA, DWA, SANRAL, etc)
* Government structures (including the provincial roads authority, municipal planning departments, etc)
* Ubuntu and Beaufort West Local Municipalities as well as Central Karoo and Pixley ka Seme District Municipalities
* Potentially affected and neighbouring landowners and tenants
* Conservation authorities
* CBOs and other NGOs.

The I&AP details were recorded within an I&AP database (refer to Appendix C for a listing of I&APs). The database will be updated on an ongoing basis during the EIA process.

» **Distribution of Background Information Documents and Reply Forms**

In order to provide information regarding the proposed project and the EIA process, a background information document (BID) and reply form for the project was compiled (refer to Appendix E). The BID was distributed to identified stakeholders and I&APs, and additional copies were made available at public venues within the broader study area.

» **Site Notices**

Five site notices (A2 size) were placed on-site. Two of these site notices were placed along a secondary road which follows the alignment of the railway line on the Farms Nobelsfontein 227 and Ezelsfontein 235. A third one was put up at the existing Biesiespoort Substation which is located on Nobelsfontein 227, and the fourth site notice was erected next to the secondary road which traverses Modderfontein 228. The fifth site notice was erected along the same secondary road traversing the northern section of the Farm Phaisantkraal 1. One A2 notice was placed at the Ubuntu Local Municipality's office in Victoria-West (refer to Appendix D for the content of the site notice and photos taken of the site notices). Additionally, A4 notices were placed at the Victoria-West Co-Operative, Victoria-West Library, Victoria-West Spar, Victoria West Post Office and also at the Victoria-West Police Station.

» **Newspaper Advertisements**

In order to notify and inform the public of the proposed project and invite members of the public to register as I&Aps, the project and EIA process was advertised by means of placing an Afrikaans advertisement in the Victoria West Messenger and an English advertisement in the Courier on the 13th August 2010 (refer to Appendix D). Advertisements to advertise the availability of the Draft Scoping Report were placed in the Victoria West Messenger and the Courier on 12 November 2010.

» **Meetings with stakeholders**

The public participation process has been structured in a manner which allows for consultation with I&APs at various levels and with different stakeholder groups. Meetings with stakeholders took place on the 5th October 2010 which included the Ubuntu Local Municipality as well as surrounding landowners. A **public meeting** will be arranged during the EIA phase and advertised in the local and regional newspapers and stakeholders will be invited to attend the meeting.

» **Other forms of Public Involvement**

In addition to the newspaper advertisements and site notices, key stakeholders and registered I&APs were notified in writing of the commencement of the EIA process. These parties included, *inter alia*:

* Relevant parties from municipalities potentially affected (directly or indirectly) by the proposed project
* Potentially affected landowners
* Organs of state having jurisdiction in respect of any aspect of the activity. including:
  - Department of Energy
  - Department of Water Affairs
  - South African Heritage Resources Agency
  - Heritage Western Cape
  - Northern Cape Heritage Authority
  - Cape Nature (Western Cape)
  - WESSA (Northern Cape)
  - Department of Transport and Public Works
  - South African National Roads Agency
  - Civil Aviation Authority
  - Ubuntu and Beaufort West Local Municipalities
  - Central Karoo and Pixley ka Seme District Municipalities

Through consultation with key stakeholders and I&APs, issues for inclusion within the issues based scoping study were identified and confirmed. In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their views, issues and concerns regarding the project, various opportunities will be provided for I&APs to have their issues noted following the release of this Draft Scoping Report for public review; this would include:

* One on one consultation meetings (for example with the directly affected landowner);
* Telephonic consultation sessions (consultation with various parties from the EIA project team, including the public participation consultant, lead EIA consultant as well as specialist consultants); and
* Written, faxed or email correspondence.

Networking with I&APs will continue throughout the duration of the Scoping and EIA processes.

3.3.3. Identification and Recording of Issues and Concerns

Issues and concerns raised by I&APs during the Scoping Phase have been consolidated in a **Comments and Response Report** (refer to Appendix E). The Comments and Response Report includes responses from members of the EIA project team and/or the project developer to either indicate how the issues will be addressed in the EIA Phase, or to provide clarification. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view will be provided.

3.3.4. Evaluation of Issues Identified through the Scoping Process

Potential direct and indirect environmental impacts that are identified within the Scoping Phase have been evaluated through desktop studies. In evaluating potential impacts, Savannah Environmental has been assisted by the following specialist consultants:

Specialist	Area of Expertise	Refer Appendix
David Hoare of David Hoare Consulting cc	Ecology, flora and fauna	Appendix F
Andrew Jenkins of Avisense Consulting	Avifauna	Appendix G
Iain Paton of Outeniqua Geotechnical Services cc	Geology and erosion potential	Appendix H
Johan Van Der Waals of Terrasoil Science	Soil and Agricultural potential	Appendix I
Lourens du Plessis of MetroGIS	Visual	Appendix J
Celeste Booth of Albany Museum	Heritage / Archaeology	Appendix K
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise	Appendix L
Ingrid Snyman of Batho Earth	Social Impact Assessment	Appendix M
Ingrid Snyman of Batho Earth	Public involvement process	-

In order to evaluate issues and assign an order of priority, it was necessary to identify the characteristics of each potential issue/impact:

» *the nature,* which includes 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) or regional

The evaluation of the issues resulted in a statement regarding the potential significance of the identified issues, as well as recommendations regarding further studies required within an EIA (refer to Appendices F - M).

3.3.5. Public Review of Draft Scoping Report

The Draft Scoping Report will be made available for public review from **16 November 2010 to 15 December 2010** at the following locations:

» www.savannahsa.com
» Victoria West Library, Kerk Street, Victoria West
» Karoo Vleisboere Cooperation, Victoria West

3.3.6. Final Scoping Report

The final stage in the Scoping Phase will entail the capturing of responses from I&APs on the Draft Scoping Report in order to refine this report. It is this final report upon which the decision making environmental authorities provide comment, recommendations and acceptance to undertake the EIA Phase of the process.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 4

This section of the Draft Scoping Report provides a description of the environment that may be affected by the proposed Karoo Renewable Energy Facility. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed facility is situated. Features 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 scoping reports contained within Appendices F - M.

4.1 Regional Setting

The study site is located on portions of the following farm portions: Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, Rietkloofplaaten 239, Modderfontein 228 and PhaisantKraal 1 in the Northern and Western Cape Province, and falls within the Ubuntu and the Beaufort West Local Municipalities. The closest town to the study site is Victoria West which is situated approximately 34 km to the north of the site.

On a regional scale the site can be accessed via a secondary road which traverses the site from east to west and which connects the N1 and N12 national roads which run to the south-east and west of the study site respectively. A number of less significant roads lead from this secondary road to various parts of the site. The N12 national road joins up with the N1 approximately 8km to the south-west of the study site. The R63 road is situated north west of the proposed development property. The 200km^2 study area is therefore nestled between the N12, N1 and R63 roads, and is well-connected to major routes in this region.

The Skietkuil (Biesiespoort) substation is located within the eastern section of the site, located on the Farm Nobelsfontein 227. The Biesiespoort/Kromrivier 132 kV distribution power line traverses the western section of study site, while the 400kV Droërivier-Hydra 2 transmission power line traverses the south-eastern portion of the Farm Phaisantkraal 1 which forms part of the study area.

4.2 Climatic Conditions

The climate of the study area can best be described as being semi-arid to arid (typical of the Northern Cape). Rainfall occurs in late summer to autumn, peaking in March. The mean annual rainfall is approximately 300 mm per year, and this area is therefore considered to be arid[2]. Mean minimum and maximum temperatures for Victoria West are -8°C and 36.6°C respectively.

4.3. Social Characteristics of the Study Area

The study area is located within the boundaries of the Northern and Western Cape Province. The local municipalities which were identified for the proposed project are the Ubuntu as well as the Beaufort West Local Municipalities. The Beaufort West Local Municipality forms part of the Central Karoo District Municipality while the Ubuntu Local Municipality forms part of the Pixley ka Seme District Municipality.

Even though a small section of the study area (farm Phaisantkraal 1) falls within the Beaufort West local Municipal area in the Western Cape Province, the Scoping report would mainly focus on the socio-economic character of the Ubuntu Local Municipal area, as well as the Pixley Ka Seme District Municipality due to the fact that the largest part of the study area is situated within these municipal boundaries. During the EIA phase, however, more focus would be placed on the Beaufort West Municipality and the Central Karoo District Municipality as these areas might also be impacted on by the proposed project.

4.3.1. Demographic Profile

According to the 2001 Census figures, the total population within the Ubuntu Local Municipality totals 16 376 which indicates a decrease in the population from the 1996 figures (population total of 19 712). The Community Survey undertaken in 2007 indicates the total population to be 16 153 which again indicates a decrease in the population (Ubuntu LM IDP, 2009). This decrease would have far reaching consequences for the municipality's service delivery, as well as with regards to grants and subsidies made available to them. The decrease could be the result of a stagnating economy that is unable to provide school leavers with sufficient job opportunities. The total population for the Beaufort West area (including Nelspoort and Merweville) was estimated at 40 000 for 2010 (BKS, 2004).

The age profile of the population reveals that the majority of the residents of the Ubuntu Local Municipality fall within the age category of 15 to 34 years (5 450 individuals), followed by the 35 to 64 age category (4 550). Approximately 3 601

[2] All areas receiving less than 400 mm rainfall are considered to be arid

individuals make up the 5 to 14 years category according to the 2001 Census Statistics. The age structure in the Beaufort West Municipal area is also very young and the majority of the economic inactive section of the population is younger than 18 years (BKS, 2004).

The level of education among the population of Ubuntu Local Municipality is relatively low which impacts on the employment potential of the population and therefore also on the local economic development and job creation initiatives (Ubuntu LM IDP, 2010). Literacy and educational levels within the Beaufort West Municipal area is also described as being low (BKS, 2004). The low level of education, mainly amongst historically previously disadvantaged females is indeed of concern.

The area is scarcely populated with the majority of the residents living in scattered towns and settlements. The farms in the study area mainly house the property owners and the farm workers. Some property owners do not permanently reside on their properties.

4.3.2. Economic Profile

According to the Statistics of South Africa's 2001 survey, the labour force in the Ubuntu Local Municipality include 6 189 individuals. This includes both the employed (66%) and unemployed (34%), but exclude those that are economically inactive, but who would normally form part of the labour market (Ubuntu LM IDP, 2009). The unemployment rate in the Beaufort West area is calculated at 58% which can be classified as high, with subsequent high poverty rates. Approximately 36% of the economically active people (18 years and older) are unemployed in the Beaufort West Local Municipality.

The labour market of the Ubuntu Local Municipality essentially represents 62% of the total population. Should those be taken into consideration, the unemployment rate of 34% could therefore be somewhat misleading due to the fact that people not seeking work, who can be classified as being unemployed, are not included. Of the employed labour force, 69% earn less than R800 per month. This gives an indication of the poverty that exists among the majority of residents living within the Ubuntu Local Municipality.

The main employment sector in the Ubuntu Local Municipal area is agriculture, more specifically livestock farming, followed by the wholesale and trade sectors. A few people are employed within the manufacturing and construction sector (Ubuntu LM IDP, 2009). Within the Beaufort West Municipal area, the majority of those employed are employed within the commerce, community services and agricultural sectors (BKS, 2004).

4.3.3. Infrastructure and Basic Services

The provision of services with regards to sanitation, potable water, housing, creation and sustaining of employment opportunities and housing remain challenges which need to be addressed.

» *Housing:* the majority of the population of the Ubuntu Local Municipality resides in formal housing. A housing backlog estimated at 1554 houses exists. The housing backlog within the Beaufort West Municipality amounts to more than 3 000 houses which are increasing on a daily basis.
» *Sanitation*: sanitation services in Ubuntu Local Municipality are provided in the formal towns, however informal settlements still make use of the bucket system which proves the need for the upgrade of the sanitation infrastructure and services provided. Within the towns of Beaufort West and Nelspoort, all areas, except a very small number of informal houses in Beaufort West itself have access to water borne sanitation.
» *Health Services*: the provision of health services in the area seem to be insufficient and therefore one of the socio-economic goals of the Ubuntu Local Municipality is the establishment of health programmes as well as the provision of improved health services (hospitals, clinics and mortuaries) to the benefit of all the residents. The high infection rate with regards to HIV/Aids as well as alcohol abuse in the region is a source of concern. Awareness creation among the local residents is critical to combat the spread of these diseases and to limit family violence and crime associated with alcohol abuse (Ubuntu LM IDP, 2009). The Beaufort West Municipal area comprise of one provincial hospital, three municipal clinics, one district municipal clinic and nine mobile clinics which provides service the rural and remote areas. In the Beaufort West area, the spread of HIV/Aids is especially worrying and it is anticipated that the disease could even lead to a decline in the population in future.
» *Water Provision*: the Ubuntu Local Municipality is located in the Karoo which can be classified as a semi-desert area. Limited natural surface water is found in the area and rainfall is low which hampers the provision of water with regards to both quantity and quality, to the water users. The majority of the residents in the Beaufort West area have access to potable water. Water services are also of a high standard.
» *Electricity Provision*: according to the IDP of 2009, all formal houses in the Ubuntu Local Municipality are provided with electricity. The electricity distribution system is however in a poor condition and needs to be upgraded. All towns within the Beaufort West Municipality have access to Eskom supplied electricity.

4.4. Heritage of the Study Area

Little is known about the archaeology of the area where the study site is located, mainly because no systematic research has been conducted. However, two relevant phase 1 archaeological impacts assessments have been conducted approximately 20km to the north-east of the proposed development along the N1 and north-east of the R63.

It has been established that the semi-arid Karoo region stretching across the Eastern Cape, Western Cape and Northern Cape is marginal regarding precolonial human settlement, although is rich in archaeological sites, rock art as well as rock engravings which are found widespread over the Karoo landscape. There is a variety of archaeology within the proposed area that may be encountered, ranging from the Early Stone Age, Middle Stone Age, Later Stone Age and pastoralism within the last 2000 years. These are described in more detail below:

» *The Early Stone Age (ESA) and Middle Stone Age (MSA)*

The Early Stone Age spans a period of between 1.5 million and 250 000 years ago and refers to the earliest that *Homo sapiens sapiens* predecessors began making stone tools. The hallmark of the Acheulian Industry is its large cutting tools, primarily handaxes and cleavers.

Various stone artifact industries occurred during this time period, although less is known about the time prior to 120 000 years ago. The large handaxes and cleavers were replaced by smaller stone tools called the Middle Stone Age flake and blade industries. During the 1920's, A.H.J. Goodwin identified the Victoria West stone artifact industry, probably referring to those artifacts with an unusual character found within the district, the wider Karoo region, as well as along the Vaal River.

It is therefore likely that surface scatters of Early Stone Age, Middle Stone Age and above-mentioned Victoria West Industry will occur within the study area.

» *The Later Stone Age (LSA) and Pastoralism within the last 2000 years*

The majority of archaeological sites found in the area would date from the past 10 000 years where San hunter-gatherers inhabited the landscape living in rock shelters and caves as well as on the open landscape. These latter sites are difficult to find because they are in the open veld and often covered by vegetation and sand. Sometimes these sites are only represented by a few stone tools and fragments of bone.

Some 2 000 years ago Khoekhoen pastoralists entered into the region and lived mainly in small settlements. They were the first food producers in South Africa

and introduced domesticated animals (sheep, goat and cattle) and ceramic vessels to southern Africa. It is likely that Later Stone Age stone artefacts and Khoekhoen pastoral archaeological remains would occur within the proposed area for development, mainly as surface scatters around the rocky outcrops. Precolonial human inhabited caves and rock shelters may also be encountered within the area proposed for development.

» *Rock Art*

Rock art is generally associated with the Later Stone Age period mostly dating from the last 5000 years to the historical period. Rock paintings occur on the walls of caves and rock shelters across southern Africa. Rock engravings, however, are generally distributed on the semi-arid central plateau, with most of the engravings found in the Orange-Vaal basin, the Karoo stretching from the Eastern Cape (Cradock area) into the Northern Cape as well as the Western Cape, and Namibia. It is possible that rock shelters and caves containing rock painting images and rock engravings on boulders and flat bedrock may be encountered within the proposed area for development.

» *Historical period*

Historical archaeology refers to the last 500 years when European settlers and colonialism entered into southern Africa. During the latter half of the 1800's, Xhosa-speaking people began migrating from the Ciskei-Transkei areas across the Karoo into the Northern Cape Karoo areas, owing to the influx of British forces, settlers and disruption of their settlement patterns. Historical archaeological research is currently being conducted approximately 70km to the north, north-west of the town of Victoria West on the historical remains of these Xhosa settlements.

The district of Victoria West also played a small part in the Anglo-Boer War as well as World War 1. During 1902 it was written in The London Gazette that "a line of blockhouses has been commenced which will ultimately run from Lambert's Bay, by Calvinia to Victoria West, a distance of over 200 miles.

It is likely that a variety of historical features and artifacts occur within the proposed study area owing to early farming activities, the region's historical settlements, movements and migrations through the area, as well as the remnants of the Anglo-Boer war and World War 1.

4.5. Biophysical Characteristics of the Study Area and Surrounds

4.5.1. Topographical Profile

The character of the topography of the study site is fairly diverse. The area is undulating with various small outcrops of rock and hills. The northern and south-western portions of the study area are characterised by mountainous terrain. The elevation ranges from 1 040m in the south west to 1 760m at the top of the hills towards the north. The topography is classed as lowlands with mountains. The terrain surrounding the site can be described as being mostly flat, but is frequently interrupted with clusters of prominent hills. The well-known tourist attraction known as the Three Sisters is in fact a cluster of such hills, and is located about 12km south of the site. Various drainage lines occur in the study area, all of which are non-perennial. Figure 4.1 provides a shaded relief map of the study area and its surrounds, which indicates the elevation above sea level in metres.

4.5.2. Geology

The study area is underlain by the Poortjie Member of the Teekloof Formation of mudstones and subordinate sandstones, which forms the upper part of the Adelaide Subgroup of the Beaufort Group (refer to Figure 4.2). The Poortjie Member has a slightly higher ratio of sandstone to mudstone when compared to the rest of the Teekloof Formation. Isolated outcrops of Hoedemaker and Oukloof Members occur overlying the Poortjie Member at higher altitudes in the southwestern, southeastern and northern extremities of the study area.

There are numerous Jurassic dolerite intrusions mapped within the study area and these features have a distinct control over the landscape development as the dolerite is generally harder than the country rocks into which they are emplaced. There are no geological faults mapped on the 1:250 000 scale map of the study area. Analysis of the geological maps and aerial photography indicates that hard rock outcrops are widespread in the upland areas of high relief.

Approximately 30% of the study site is underlain by highly erodible alluvium (sediment which is deposited along drainage lines or on the riverbanks) or colluvium (sediment that has been transported by downslope gravity and deposited at the bottom of a slope). The remaining 70% of the study area comprises rocky outcrops or coarse talus/scree deposits which have a low erosion potential.

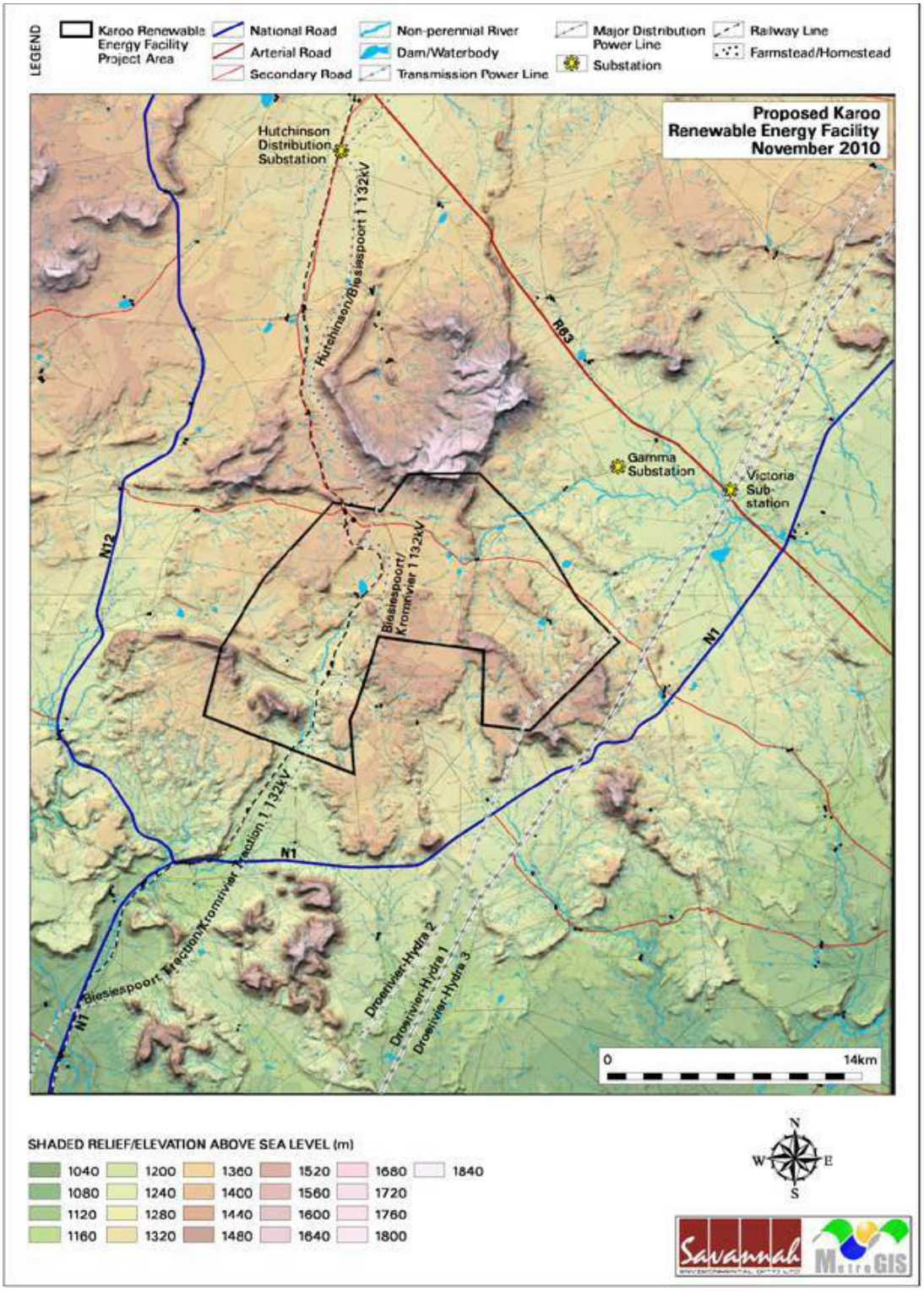

Figure 4.1: Shaded relief map of the study area indicating elevation above sea level (in metres)

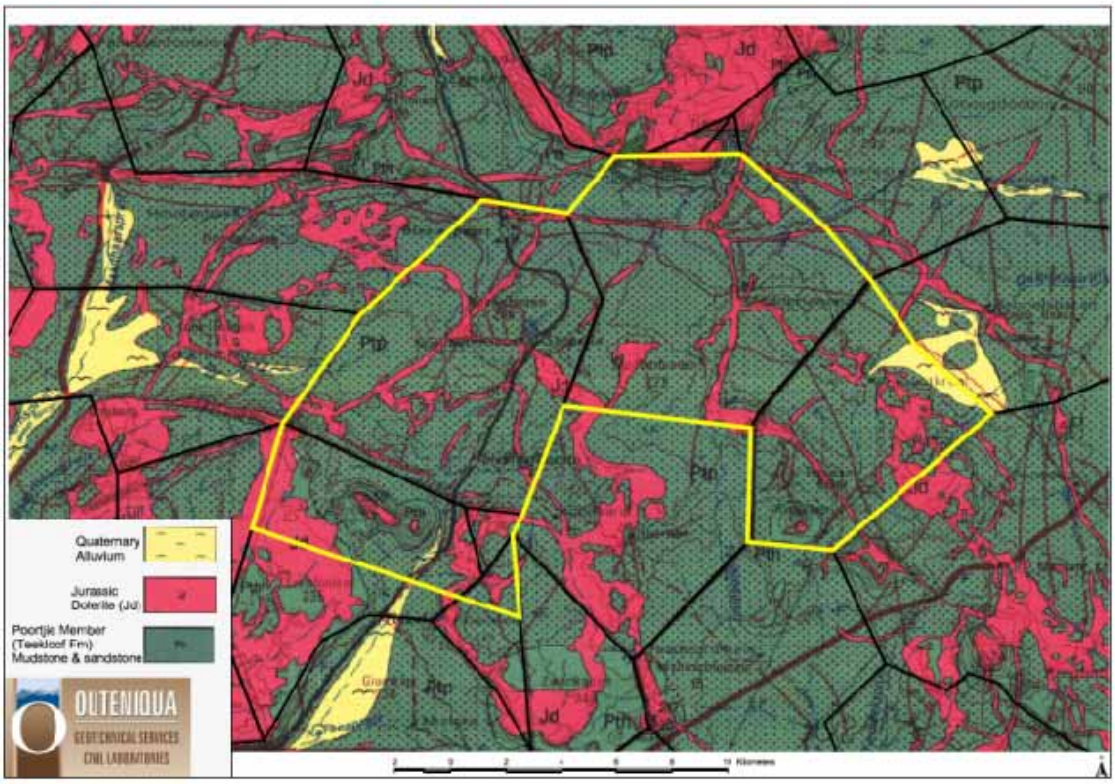

Figure 4.2: Geology of the study area

4.5.3. Soils, Agricultural Potential and Land Capability

The soils of the majority of the study area are shallow in nature, and overlie hard or weathering rock and are of low agricultural potential. The study area is covered by three land types, as shown in Figure 4.3, namely Fb, Ia and Ib. The Fb land type is described as Glenrosa and/or Mispah forms and accommodates pedologically young landscapes. The most dominant soil forming process is that of weathering which gives rise to orthic topsoil horizons and clay illuviation. The Mispah and Glenrosa soil forms dominate this landscape. The Ia land types indicate that at least 60% of the soils of these land types are pedologically youthful, deep and unconsolidated deposits, while the Ib land type indicates that exposed rock make up 60% to 80% of the land type.

The Fb land type dominates the northern, eastern and a portion of the southern sections of the area, while the western section and a portion of the southern section are dominated by the Ia and Ib land types. The soil of the Ia95 land type (south-western portion of the site) comprise deep, well-drained soil that exhibit a weak or moderate developed structure. These are soils of high agricultural potential. These soils are mainly of the Oakleaf, Hutton and Valsrivier soil forms. The low rainfall, however, inhibits dry-land crop production. It is unsure whether an adequate water source is available for irrigation. The Ib285 land type is dominated by rock outcrops and is of low agricultural potential. The soils of the

majority of the study area are generally shallow, overlying hard or weathering rock, and are of low agricultural potential.

4.5.4. Ecological Profile

The study area is located within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). 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) which indicates three vegetation types occurring within the study site, namely Eastern Upper Karoo, Southern Karoo Riviere and Upper Karoo Hardeveld (refer to Figure 4.4). These three vegetation types are described in more detail below.

Eastern Upper Karoo occurs on flats and gently sloping plains and is dominated by dwarf microphyllous shrubs with grasses from the genera Aristida and Eragrostis (Mucina et al. 2006). There are some endemics in this vegetation, including the succulent shrubs.

Southern Karoo Riviere is found on the narrow riverine flats in the southern parts of the Karoo, especially on heavier and salt-laden soils on broad alluvia (Mucina *et al*. 2006). It consists of a complex of Acacia karroo thickets up to 5 m tall fringed by tall Salsola-dominated shrubland up to 1.5 m tall.

Upper Karoo Hardeveld is found on steep slopes of koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation is a sparse dwarf Karoo scrub with drought tolerant grasses of genera such as *Aristida, Eragrostis* and *Stipagrostis*. There are a number of endemics in this vegetation (Mucina *et al*. 2006), including succulent shrubs, low shrubs, tall shrubs, herbs and succulent herbs.

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

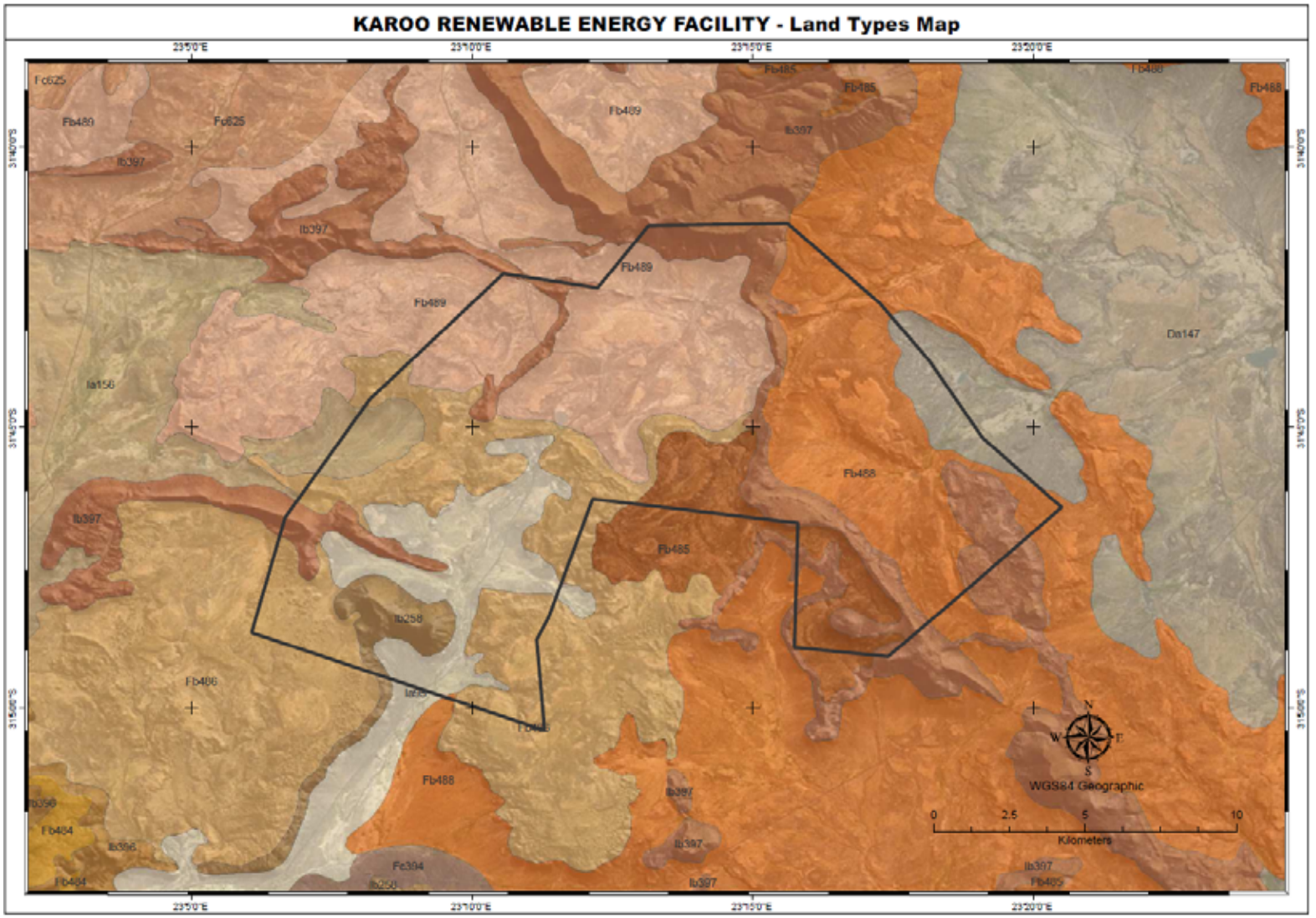

Figure 4.3: Fb, Ia and Ib land types occurring within the identified study site for the proposed Karoo renewable energy facility

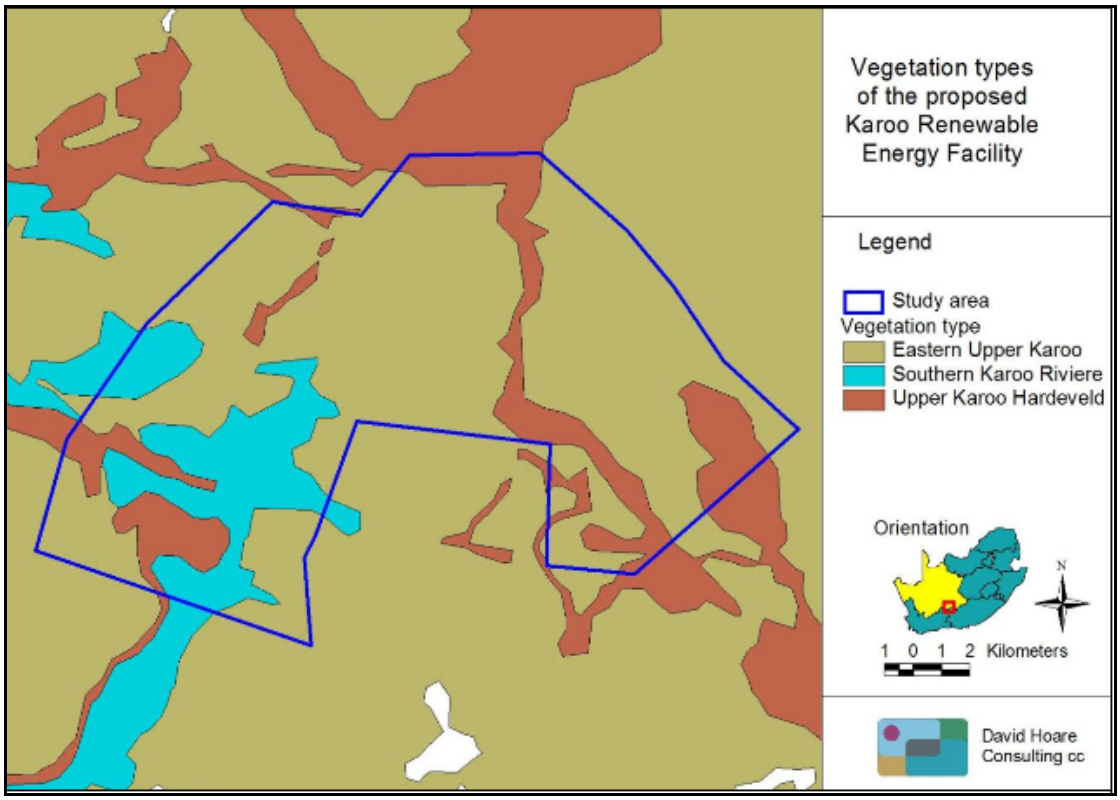

Figure 4.4: Map illustrating the vegetation types in the study area

Red Data Species

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 specialist study (Appendix F). Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed. There is one species on this list, *Aloe broomii var tarkaensis*. According to collection information and published accounts of the species, there is some doubt as to whether it occurs in the study area or not. According to IUCN Ver. 3.1 (IUCN, 2001), this species is listed as Rare. There are, therefore, no threatened, near threatened or critically rare species that could potentially occur on site. There are no protected trees that have a geographical distribution that includes the study area.

All Red List vertebrates (mammals, reptiles, amphibians) that could occur in the study area are listed in Appendix 2 of the ecology specialist study.

There is one threatened mammal species classified as Critically Endangered, the Riverine Rabbit that could occur in available habitats in the study area. This species is found in riverine vegetation on alluvial soils adjacent to seasonal rivers. There are three mammal species of low conservation concern that could occur in

available habitats in the study area. This includes three species classified nationally as Near Threatened, the Honey Badger, Geoffroy's Horseshoe Bat and Leseur's Wing-gland Bat, all three of which are classified as Least Concern globally.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on site. This species is classified as Least Concern globally and Near Threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act.

There is one reptile species of conservation concern that has a distribution that includes the study area and which could occur in available habitats in the study area. This is the Namaqua Plated Lizard, classified as Near Threatened. This species is found in dry sandy areas, bare rocky hillsides and Acacia scrub.

Avifauna/Birds

The site falls just to the west of the Platberg-Karoo Conservancy Important Bird Area (Barnes 1998), which is known to support critical or regionally significant populations of Red-listed species such as Ludwig's and Kori Bustards, Blue Korhaan, Blue Crane, Secretarybird, Martial Eagle, Tawny Eagle, Lesser Kestrel and Greater Flamingo.

The study area supports over 220 bird species, including 15 Red-listed species, 70 endemics, and five red-listed endemics. Resident populations and/or seasonal arrivals of large terrestrial birds including the Ludwig's Bustard and Blue Crane, a range of locally resident or visiting raptors, in particular Martial Eagle, Verreaux's Eagle, and possibly Lanner Falcon and Peregrine Falcon, and a suite of restricted range and/or endemic passerines, are the species of greatest conservation significance which may be impacted by the renewable energy facility. The impact is in terms of the collision, displacement and disturbance impacts of the facility itself, and of the disturbance and mortality risks posed by its peripheral infrastructure.

Avian microhabitats include mostly dry, open Karoo veld, degraded by grazing but otherwise intact. Wetlands may comprise a number of temporary water bodies and scattered small farm dams.

SCOPING OF ISSUES ASSOCIATED WITH THE KAROO RENEWABLE ENERGY FACILITY CHAPTER 5

The potential impacts of the predominant phases of the proposed development (i.e. construction and operation) are identified, described and evaluated in this chapter. The majority of the environmental impacts are expected to occur during the construction phase for a facility of this nature.

5.1 Methodology for Impact Assessment during the Scoping Phase

The following methodology was used to determine the main issues and potential impacts of the proposed project during these phases:

» Identify **sensitive environments** and **receptors** that may be impacted on by the proposed facility and the **types of impacts** (i.e. direct, indirect and cumulative) that are most likely to occur.
» Determine the **nature and extent of potential impacts** during the construction and operational phases.
» Identify '**No-Go' areas**, if applicable.
» Summarise the potential impacts that will be **considered further** in the EIA Phase through specialist assessments. Table 5.1 and 5.2 summarise the findings of the Scoping Phase undertaken for the construction and operation phases of the proposed Karoo Renewable Energy facility (the pre-construction and decommissioning phases will be discussed in further detail in the EIA Phase).

5.1.1 Sensitive Environments and Receptors

The proposed facility has the potential to have an impact on the following environmental receptors (prior to the implementation of mitigation measures):

» **Ecology, fauna and flora:** the disturbance associated with activities during the construction phase may impact on flora and fauna populations through disturbance or destruction of potential habitat. During the operational phase, regular maintenance activities may impact on fauna due to disturbance.
» **Birds:** the potential for impact in terms of the collision, displacement and disturbance impacts of the facility itself, and of the disturbance and mortality risks posed by its infrastructure.
» **Visual quality and aesthetics:** the construction and operation of the renewable energy facility and the associated infrastructure (i.e. power line and substation) has the potential to impact on the visual quality of the landscape.

- **Sensitive noise receptors:** the construction and operational phase of the proposed development may result in noise impacts on sensitive noise receptors located in the immediate area.
- **Social characteristics:** the construction and operational phases of the proposed facility may result in both temporary and/or longer term employment opportunities, most likely to be of a basic and semi-skilled nature. The influx of construction workers and/or potential job seekers could impact on existing infrastructure and social behaviour, and both of a positive and/or a negative nature.
- **Geology, Soils and Erosion potential:** excavation activities during the construction phase and water run-off during the operational phase has the potential to impact on the soil conditions and the erosion potential of the site.
- **Heritage sites and fossils:** disturbance to or destruction of heritage sites and fossils may result during the construction phase.
- **Agricultural potential:** construction activities such as excavations, earthworks and the activities associated with construction works and equipment on-site may lead to soil degradation, pollution and erosion, which could impact on the agricultural potential and land capability of the area.

Table 5.1 and Table 5.2 below provide a summary of the findings of the scoping study which was undertaken for the construction and operation phases of the proposed project respectively. Potential direct and indirect impacts of the combined wind and solar energy facility are evaluated, and recommendations are made regarding further studies required within the EIA phase of the process. While evaluating potential impacts associated with the proposed project, it has been assumed that the **development footprint** (the area to be affected during the operational phase) will include the footprints for the photovoltaic solar facility component (i.e. PV panels), footprints for the wind energy facility component (i.e. wind turbine foundations), the on-site substation, as well as the associated infrastructure (i.e. internal access roads and overhead power line). However, during the construction phase, a larger extent of the broader site required for the proposed facility could suffer some level of disturbance, and is referred to as the **construction footprint**.

Table 5.1: Evaluation of potential impacts associated with the **Construction Phase**

Impacts on Fauna and Flora and Ecology

The preliminary sensitivity assessment identifies those parts of the study area that could possibly have high conservation value or that may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 5.1 in yellow. It must be emphasised that this is a preliminary map based on a desktop scoping level assessment. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms, or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has little/no importance for the functioning of ecosystems is considered to potentially have low sensitivity. Broad scale mapping was used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

- Perennial and non-perennial rivers, streams and drainage lines: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal; and
- Potential occurrence of populations of a Red List animal species that has been evaluated as having a high chance of occurring within natural habitats within the study area (the Riverine Rabbit).

These factors have been taken into account in evaluating sensitivity within the study area. Indications are that drainage lines on site could potentially be classified as sensitive. From a sensitivity point of view, the higher order drainage lines are more important to map correctly. The main drainage lines are more sensitive and, therefore, important to protect.

A risk assessment was undertaken which identified four main potential negative impacts on the ecological receiving environment. The significance of these impacts will be assessed during the EIA phase after collection of relevant field data. An initial assessment indicates that some of these impacts are likely to be significant or that there is a legislative benefit to establishing whether they will occur or not. The identified potential impacts which need to be evaluated further are the following:

1. Impacts on indigenous natural vegetation
2. Impacts on threatened animals
3. Impacts on wetlands and/or watercourses
4. Establishment and spread of declared weeds and alien invader plants

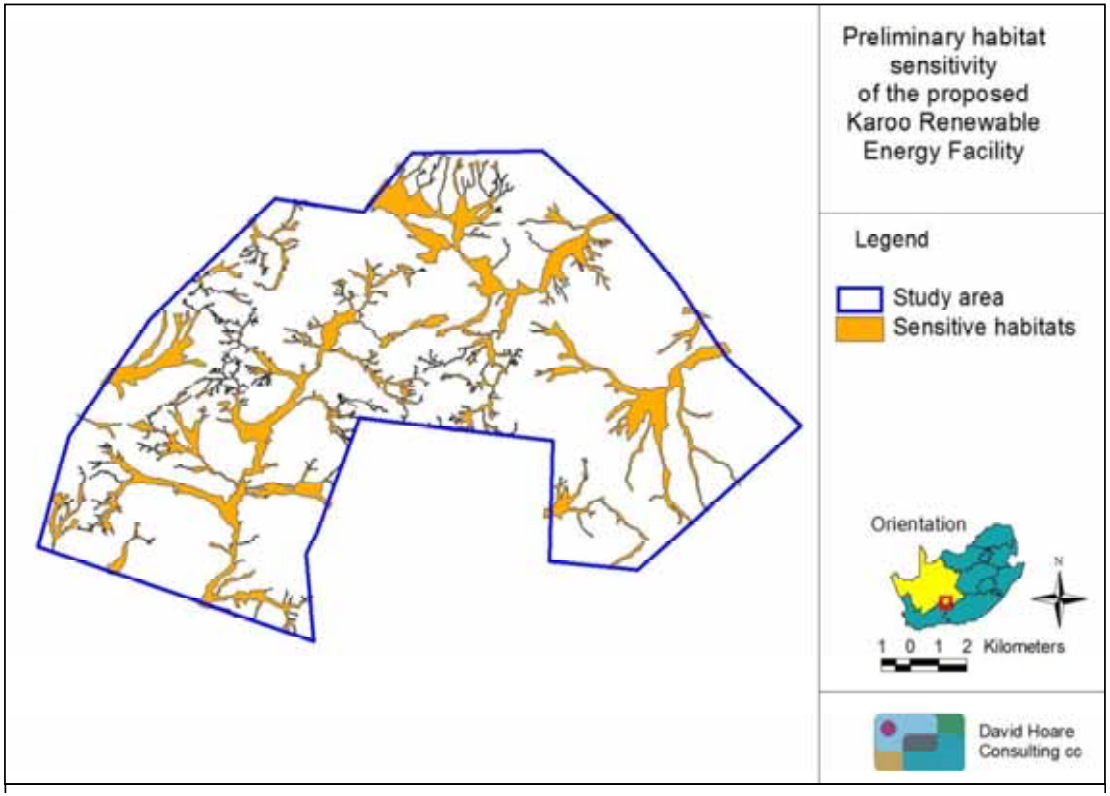

Figure 5.1 Preliminary habitat sensitivity illustrating areas of potentially high sensitivity

Issue	Nature of Impact	Extent of Impact
Impacts on indigenous natural vegetation	The construction of infrastructure will lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, 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). The general condition of the vegetation on site can only	Local – Regional

	be assessed during the field survey to be undertaken during the EIA phase. Consequences of the potential impact of loss of indigenous natural vegetation occurring may include: » negative change in conservation status of habitat; » increased vulnerability of remaining portions to future disturbance; » 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; » loss of ecosystem goods and services.	
Impacts on threatened plants	Plants are affected by the overall loss of habitat but are especially vulnerable to infrastructure development as they cannot move out of the path of construction activities. There are no threatened plants that are likely to occur on site. This potential impact will therefore not occur.	None
Impacts on protected tree species	According to the National Forests Act, 1998 (Act No. 84 of 1998) no person may cut, disturb, damage or destroy any listed protected tree species. There are no protected tree species that have a geographic distribution that includes the study area. This potential impact will therefore not occur.	None
Impacts on threatened animal species	Threatened species include those classified as critically endangered, endangered or vulnerable. 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. 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. They could be indirectly 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. Consequences may include: » Fragmentation of populations of affected species » Reduction in area of occupancy of affected species	Local - Regional

	» Loss of genetic variation within affected species These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances. It has been evaluated that there are three animal species of conservation concern that could occur in available habitats in the proposed study area. These are the Riverine Rabbit (Critically Endangered), Namaqua Plated Lizard (Near Threatened) and the Giant Bullfrog (Least Concern, but protected). The site is, therefore, considered to be important for one threatened animal species and two species of lesser conservation concern.	
Impacts on wetlands and watercourses	The site is located in a very arid area. There are unlikely to be any wetlands on-site, but there are clearly a number of dry stream beds and drainage areas. According to the National Water Act (Act 36 of 1998), these are classified as wetlands or water resources. Construction may lead to some direct or indirect loss of or damage to some of these areas or changes to the catchment of these areas. This may affect the hydrology of the landscape or lead to loss of habitat for species that depend on this habitat type.	Local - Regional
Establishment and spread of declared weeds and alien invader plants	A major factor contributing to invasion by alien invader plants includes the high disturbance related to construction activities of such a facility). 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 » Impairment of wetland function It is not known to what extent the site contains alien plants. The shrub, *Prosopis glandulosa*, is potentially the most problematic. This species invades riverbeds, riverbanks and drainage lines	Local - Regional

	in semi-arid and arid regions and has been recorded near to the site. There is, therefore, the potential for alien plants to spread or invade following disturbance on site.	

Recommendations for further study

The following activities will be undertaken as part of the Ecological Specialist Study during the EIA Phase:

» Conduct a site visit in order to assess the general vegetation condition of the site and to identify areas that are in good condition versus those areas in poor condition. This will provide the context for assessing impacts on natural vegetation.
» The presence and distribution of wetlands (i.e. such as drainage lines) on site will be confirmed. This will be done primarily using aerial photograph interpretation, but will be confirmed in the field.
» The presence of species of concern will be evaluated. For plant species this will be done by searching for populations that could occur in the study area based on habitat requirements and historical collection records. For animal species this will be done by assessing habitat suitability for those species that have been assessed as potentially occurring in the area. Particular attention will be paid to Red Data Species.
» Assess the potential impacts using a weighting system that assigns a value to the categories (extent, duration, magnitude, probability) and arrives at a total which depicts the significance of the particular impact.
» Prepare a specialist report detailing the environmental issues and potential ecological impacts.
» Provide mitigating measures to input into the EMP.

Impacts on Avifauna (Birds)

Although the final, permanent development footprint of most renewable/wind energy facilities is likely to be relatively small, the construction phase of development inevitably incurs quite extensive temporary damage or permanent destruction of habitat, which may be of lasting significance in cases where renewable energy facility sites coincide with critical areas for restricted range, endemic and/or threatened species. Similarly, construction, and to a lesser extent ongoing maintenance activities, are likely to cause some disturbance of birds in the general surrounds, and especially of shy and/or ground-nesting species resident in the area.

Perhaps the most significant potential impact on birds of any solar energy facility is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. Given the considerable space requirements of commercially viable facilities this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and allowing for the possible cumulative effects of multiple facilities in one area.

Issue	Nature of Impact	Extent of Impact
Impacts on birds by wind and solar energy facilities and associated infrastructure	Disturbance of birds during construction. Ground-nesting and/or terrestrial species, raptors and smaller endemics will be most affected	Local
Impacts on birds by wind and solar energy facilities and associated infrastructure	Destruction of habitat during construction. Endemic passerines will be most affected.	Local

Recommendations for further study:

The EIA phase will emphasise the outcome of the site visit, which in turn will include:

(i) Absolute or sample surveys of large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance of local populations of these key taxa.

(ii) Estimates of the extent and direction of possible movements of these species within/through the anticipated impact zone of the renewable energy facility, in relation to the distribution of available resources – nesting or roosting sites (e.g. cliff-lines, wetlands, stands of trees, existing power lines) and foraging areas (e.g. wetlands, rocky screes and ridges).

(iii) Identification of the least sensitive/lowest risk areas to locate wind turbines and solar panels within the broader study area, in terms of (i) and (ii) above.

(iv) Provide mitigating measures to input into the EMP.

The results will include a more detailed assessment of all impacts, recommended mitigation where necessary (particularly with reference to the siting of turbines and solar panels) and, perhaps most importantly, a comprehensive, long-term programme for monitoring actual impacts from pre- to post-construction phases of the development, and improving our understanding of the long-term effects of wind energy developments on South African avifauna.

Noise Impacts

The preliminary noise assessment indicated that while the character of the area might be rural, there are numerous potential receptors living within a

radius of 2 000 m from/in the area. The impact from the proposed facility on identified potential sensitive receptors will be calculated only during the EIA phase using the CONCAWE method as stipulated by SANS 10357:2004. This assessment indicated that the proposed project could have an impact of a low to high significance on the noise climate in the surrounding area in the unmanaged situation, as there are numerous potentially sensitive receptors within the area of influence. The status of the potential sensitive receptors will be established during the EIA phase.

Potential noise sources during construction could include:

» Construction Equipment: the equipment likely to be required to complete the above tasks will typically include: excavator/grader, bulldozer, dump trucks, vibratory roller, bucket loader, rock breaker, (potentially) drill rig, excavator/grader, bulldozer, dump truck, flat bed trucks, concrete truck(s), cranes, fork lift and various 4WD and service vehicles.
» Material supply: Concrete batching plants and / or use of Borrow Pits.
» Traffic noise: additional traffic to and from the site, as well as traffic on the site.

Issue	Nature of Impact	Extent of Impact
Noise impacts from construction machinery	On-site construction noise associated with the establishment of the renewable energy facility.	Local
Noise impacts from material supply sources	Instead of transporting the required material to the site using concrete trucks, portable concrete batching plants may be required to supply concrete on-site. Batching plant equipment may be relocated between the sites as the works progress to different areas of the site. The need for such batching plants, the number, and whether they will be moved is yet unknown. Neither is it known whether the developer may make use of a borrow pit (for aggregate material) and a portable rock crusher plant and screen.	Local
Noise impacts from traffic	Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period.	Local

Recommendations for further study

The following work is planned for the Environmental Impact Assessment phase:

» Site visit to measure the site-specific background ambient noise levels.
» Site visit to confirm the presence of the identified receptors.
» Projected impacts from the construction phase can only be modelled once more information regarding the duration of construction and equipment used are known.

- During the EIA phase construction activities such as concrete batching/delivery, foundation preparation, the digging of trenches and increased traffic (deliveries and movement onsite) will be considered, taking cognisance of the worst case scenario (close to a potential sensitive receptor).
- Using the data (proposed processes, noise characteristics of the selected equipment, and preliminary locations of the wind turbines) as provided by the project developer, the predicted impact of the wind energy facility on receptors will be predicted using the CONCAWE method as stipulated by SANS 10357:2004 for the construction phase.
- Using the calculated noise levels at the identified sensitive receptors, the projected significance of the construction of the facility will be determined using the criteria as proposed (subject to possible changes after any stakeholder input).
- The following information is required:
  - The available meteorological data,
  - An overview of the equipment, processes and schedules for the construction phase.
- Provide mitigating measures to input into the EMP.

Impacts on the Social Environment

Social impacts can be defined as the consequences to human populations of any public or private actions (these include policies, programs, plans and or projects) that alter the way in which people live, work, play relate to one another, organise to meet their needs and generally live and cope as members of society.

Based on the initial assessment of the receiving environment and the anticipated impacts associated with the wind energy and solar energy facility, it is concluded that there are no fatal flaws associated with the project at this stage. The main potential social benefits associated with the construction of the proposed Karoo Renewable Energy Facility refers to the job opportunities, the creation of "green energy" and possible socio-economic spin-offs created through the process. The majority of social impacts are of a moderate significance, but are anticipated to respond to mitigation or enhancement measures.

Issue	Nature of Impact	Extent of Impact
Job creation	During the construction phase some locals would be able to secure employment, as those semi-skilled and even unskilled labourers could be trained to assist with the construction of the solar panels and mounts. General construction related activities associated with the wind energy facility would also create temporary employment opportunities. It is anticipated that community members from Victoria West and Hutchinson can be sourced. Some specialists would also be	Local - Regional

	required who would probably be sourced from elsewhere in South Africa, or even internationally.	
Inflow of workers	An increase of people movement in an area usually creates the perception that criminal activities will increase. This would probably be the perception among property owners in the study area irrespective of whether local people or outsiders are employed. Concerns relate to small livestock theft and damage to or theft of fences. A large workforce could furthermore impact on the existing social networks through conflict between the locals and outsiders, as well as the spread of sexually transmitted diseases.	Local
Accommodation of workforce	Should the workforce be accommodated on site (which is highly unlikely and not preferred) it could result in environmental pollution and social problems between the workforce and locals residing in the area (e.g. landowners and farm workers). Should an outside workforce be accommodated at nearby accommodation facilities or in towns within close proximity to the study area such as Victoria West or Hutchinson it could be beneficial to the local hospitality industry, but in worst cases could also result in conflict between the outsiders and the local community members.	Local - Regional
Impacts on daily living and movement patterns	Construction-related activities could impact on the daily living and movement patterns of the locals due to e.g. increased construction vehicle activity on the local gravel roads, increased noise and possible construction of new access roads on site. Farming activities could furthermore be negatively impacted on by general intrusions and noise associated with the construction activities. At this stage it appears that no residential dwellings are located in close proximity to the proposed construction site and the impact is therefore anticipated to be minimal.	Local
Local procurement	At this stage it is not anticipated that local procurement would be achievable for the technology requirements associated with a project of this nature. Local procurement would be more focused on the procurement of general construction materials and goods.	Regional
Increased amount of construction vehicles	Large volumes of construction vehicles would be transporting goods and materials to the construction site. Even though the N12 is being upgraded, an increase in heavy vehicles adds to the risk of accidents. Damage to the local gravel road's surface is a further source of concern, as well as risks to animals and pedestrians crossing the road.	Local - Regional
Impact on farming activities	The construction activities (noise, dust and intrusion) could impact on farming activities and existing farming activities would not be able to continue on site during the construction phase. The intensity of the impact would thus depend on the type of activities undertaken on the properties and whether stock can easily be moved to other grazing areas.	Local

Impact of power line	The construction activities associated with the construction of the power line, approximately 6 km in length, would impact on the daily living and movement patterns of those property owners affected. At this stage it is anticipated that the proposed power line could link at the Biesiespoort Substation located on the farm Nobelsfontein 227.	Local - Regional

Recommendations for further study

The following activities will be undertaken as part of the Social Specialist Study during the EIA Phase:

» Further literature review
A comprehensive literature review and analysis would be undertaken during the EIA phase of the project. This would assist the consultants to acquire further demographic and socio-economic information with regards to the receiving environment and to build on the initial profiling of the local population's socio-economic characteristics.

» Consultation sessions and fieldwork
During the EIA Phase additional primary data would also be gathered by means of consultation with the stakeholders and affected parties, and linkages with the public participation process.

» Analysis of data compiled by parallel studies
If available, the social impact assessment team will study and analyse the information gathered by the biophysical studies. This would assist the social team to assess the impact of the proposed development on the direct (surrounding communities) and indirect (regional) environment.

» Variables to be assessed and impacts to be rated
  * Population impacts;
  * Community/institutional arrangements;
  * Conflicts between local residents and newcomers;
  * Individual and Family level impacts;
  * Community infrastructure needs; and
  * Intrusion impacts.

» Significance Criteria
  * During the EIA phase, the anticipated social impacts would be rated according to a specific rating approach which would include the extent of the impact, the probability of the impact occurring, the magnitude, the duration of the impact and its significance, as stipulated by Savannah Environmental.

» Writing of the Social Impact Assessment report
» Provide mitigating measures to input into the EMP.

Impacts on Geology, Soils and Erosion Potential

The study has identified that degradation of the natural soil, in various manners, is the main geological impact associated with the proposed activity. Wind and water erosion is deemed to be of importance due to the presence of fine unconsolidated soils in the area (colluvium and alluvium). An overview of the geology and physical characteristics of the site has revealed that approximately 30% of the study area is underlain by potentially sensitive or erodible Quaternary soils but the texture and thickness of the soils, state of consolidation and lithification, the slope gradients and the vegetation cover are the controlling factors in determining the severity. The significance of the main direct impacts that have been identified is considered medium but further investigations on site can provide more details with regards to the spatial distribution of potentially erodible soils.

Construction related activities which could impact on the overall geology of the study site include:
» Excavation activities
» Land clearing
» Construction of access roads
» Stockpiling
» Mixing
» Wetting

Issue	Nature of Impact	Extent of Impact
Rock removal	Removal of rock due to excavations for foundations, underground services and access roads	Local
Soil removal	Removal of soil due to excavations for foundations, underground services and access roads	Local
Soil alteration	Alteration of soil texture, density, structure and chemistry due to soil mixing, wetting, stockpiling and compaction	Local
Soil pollution	Pollution of *in situ* soil due to spillage of hazardous substances such as fuel, oil and cement	Local
Soil erosion	Loss of soil by water or wind erosion	Local
Siltation downstream/ downwind	Alteration of soil processes due to abnormal siltation arising from accelerated erosion	Regional

Recommendations for further study

» Further investigations on site can provide more details with regards to the spatial distribution of potentially erodible soils. To this end, a visual assessment of the study area should be undertaken in the EIA phase.
» Simultaneously, a basic geotechnical engineering assessment of the site should also be undertaken in the EIA phase to determine the constraints on the development which may affect the positioning of the components within the facility.
» Provide mitigating measures to input into the EMP.

Heritage Impacts

It has been established that the semi-arid Karoo region stretching across the Eastern Cape, Western Cape and Northern Cape seems marginal regarding precolonial human settlement although is rich in archaeological sites and rock art. There is a variety of archaeology within the proposed area that may be encountered, ranging from the Early Stone Age, Middle Stone Age, Later Stone Age and pastoralism within the last 2000 years. Fossil bones may be found embedded in geological deposits which might be disturbed during the construction phase thus affecting their significance. Historical artefacts and features may also be rife within the proposed area owing to the settlement and migrations of early travelers and settlers, and influence from the Anglo-Boer War and World War 1.

Construction related activities which could impact on the heritage resources of the study site include:

» Land clearing and excavation activities for both linear (i.e. Power line and access roads) and area developments (i.e. Substation, PV and wind turbine footprints)
» Establishment of borrow pits (if deemed necessary)

Issue	Nature of Impact	Extent of Impact
Impacts on in situ heritage sites	Physical disturbance of the material itself and its context affecting their significance.	Local. Deep excavations will potentially impact buried archaeological material, similarly excavation of cable trenches and

		clearing of access roads could impact material that lies buried in the surface sand.
Impacts on the built environment	It is not expected that the built environment will be directly impacted by the proposed facility unless it becomes necessary to demolish structures that are greater than 60 years of age.	No impacts expected.
Impacts on palaeontology	Physical disturbance of fossil material itself and its context affecting their significance.	Regional - international

Recommendations for further study

The following activities will be undertaken as part of the Heritage Specialist Study during the EIA Phase:

» A full phase 1 archaeological impact assessment be conducted to establish the range and importance of the exposed and *in situ* archaeological heritage materials and features, the potential impact of the development and to make recommendations to minimize possible damage to these sites.
» Provide mitigating measures to input into the EMP.

Impacts on Agricultural potential and land capability

The nature of the impact on soils includes the compaction and possibly the stripping and stockpiling of soil for construction purposes. Heavy machinery traffic on the soil surface could constitute further impacts on soil.

Compaction, stripping and stockpiling of soil usually result in:
» Loss of the original spatial distribution of natural soil forms and horizon sequences.
» Loss of natural topography and drainage pattern.
» Loss of original soil depth and soil volume.
» Loss of original fertility and organic carbon content.
» Soil compaction will adversely affect root development, effective soil depth and general soil fertility (in certain instances extensive surface crusting can occur that has a negative impact on revegetation efforts).

Issue	Nature of Impact	Extent of Impact

Compaction, stripping and stockpiling of soil	Compaction, stripping and stockpiling of soil during construction.	Local

Recommendations for further study

It is recommended that the Environmental Impact Assessment (EIA) include a reconnaissance survey of the area to verify the deductions made from the desktop study (scoping report) and to shed light on the following:

» Soil form and distribution;
» Soil texture, structure and organic matter content (factors influencing erosion);
» Vegetative stand, surface crusting and surface particle size distribution (factors influencing dust production);
» Possible occurrence of wetland areas.

However, the abovementioned aspects will be covered by other relevant specialist studies which will be undertaken during the EIA phase. It will therefore not be necessary/relevant to undertake a survey of the site during the EIA phase in terms of Agricultural potential and land capability.

Table 5.2: Evaluation of potential impacts associated with the **Operational Phase**

Impacts on Fauna and Flora and Ecology

Operation related activities which could impact on the fauna, flora and overall ecology of the study site include:

» Maintenance of surrounding vegetation as part of management of the facility.

Potential impacts associated with these activities include *inter alia:*

» Spread of declared weeds and alien invader plants

Issue	Nature of Impact	Extent of Impact
Establishment and spread of declared weeds and alien invader plants	A major factor contributing to invasion by alien invader plants includes the high disturbance related to operational activities of such a facility. It is not known to what extent the site contains alien plants. There is therefore the potential for alien plants to spread or invade following disturbance on site.	Local – Regional

Recommendations for further study

The following activities will be undertaken as part of the Ecological Specialist Study during the EIA Phase:

» Prepare a specialist report detailing the environmental issues and potential ecological impacts.
» Assess the potential impacts using a weighting system that assigns a value to the categories (extent, duration, magnitude, probability) and arrives at a total which depicts the significance of the particular impact.
» Provide mitigating measures to input into the EMP for the potential for alien plants to spread or invade the study site.

Impacts on Avifauna (Birds)

Collision with the turbine blades and power lines is potentially the most significant impact of the proposed development, and could negatively affect a variety of collision prone species, most notably individuals or loose flocks of Ludwig's Bustard and Blue Crane, and a suite of both diurnal and nocturnal predatory birds present in the area, especially Martial and Verreaux's Eagles.

Of the 15 conservation priority red-listed species that could potentially occur in the study area, all are considered to be at some risk of colliding with the blades of the turbines or associated power lines. Five species are considered to be at risk of electrocution on any bird-unfriendly power infrastructure associated with the renewable energy facility.

Influxes or passages of wetland birds, especially Greater Flamingo, might be at risk of colliding with the turbine blades, or mistaking the banks of solar panels for expanses of water and injuring themselves in attempts to land on the panels. Locally resident large terrestrial birds and raptors may also be displaced from significant areas of foraging or breeding habitat by the action or noise of the turbines, or physically by the space occupied by the solar arrays.

Issue	Nature of Impact	Extent of Impact
Impacts on birds associated with the wind and solar energy facility	Collision of birds with turbines and solar panels	Potentially regional impacts
Impacts on birds associated with ancillary infrastructure (power line, substation)	Electrocution of birds on associated infrastructure	Potentially regional impacts
Impacts on birds associated with maintenance	Disturbance of birds during maintenance operations	Local - Regional

Recommendations for further study:

The scoping phase has identified potential avifaunal issues associated with the proposed wind energy facility and its possible associated infrastructure. These issues will be investigated in more detail during the full EIA phase. In particular, the significance of bird collisions with the turbines and power lines will be assessed in order to determine whether the risk warrants mitigation such as no-go areas for turbines or periodic shutting down of the wind energy component. This will be assessed mainly in terms of (i) the actual or estimated abundance of priority bird species in the area, and (ii) the distribution of relevant microhabitats and food resources, and the way in which the latter is likely to influence aggregation and movement of these birds through the impact zone of the proposed facility.

The EIA phase will emphasise the outcome of the site visit, which in turn will include:

(i) Absolute or sample surveys of large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance of local populations of these key taxa.

(ii) Estimates of the extent and direction of possible movements of these species within/through the anticipated impact zone of the renewable energy facility, in relation to the distribution of available resources – nesting or roosting sites (e.g. cliff-lines, wetlands, stands of trees, existing power lines) and foraging areas (e.g. wetlands, rocky screes and ridges).

(iii) Identification of the least sensitive/lowest risk areas to locate wind turbines within the broader study area, in terms of (i) and (ii) above.

The results will include a more detailed assessment of all impacts, recommended mitigation where necessary (particularly with reference to the siting of turbines) and, perhaps most importantly, a comprehensive, long-term programme for monitoring actual impacts from pre- to post-construction phases of the development, and improving our understanding of the long-term effects of wind energy developments on South African avifauna.

Visual Impacts

In order to determine the general visual exposure of the area under investigation, preliminary viewshed analyses simulating the proposed structures associated with the facility were undertaken. The result of the preliminary viewshed analyses for the proposed facility is indicated in Figure 5.2. This was done in order to determine the general visual exposure of the area under investigation, simulating the proposed structures associated with the facility. It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore suggesting a worst-case scenario.

The photovoltaic panels are not expected to exceed 12m in height, and the ancillary infrastructure will be similarly low-rising. The viewshed of these structures are thus accepted to be covered within the turbine visibility range. The construction and operation of the Karoo Renewable Energy Facility will in all likelihood have a visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 10 km radius of the facility.

Issue	Nature of Impact	Extent of Impact
Visual impacts	Visual exposure to wind turbines and solar panels as well as the associated infrastructure (i.e. the substation; associated power line and internal access roads).	Local - Regional

Recommendations for further study:

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine the issues related to the visual impact and ultimately the significance of the visual impact. The additional analyses should be undertaken for the core wind energy facility as well as the ancillary infrastructure, as these structures (e.g. the substation and power lines) are envisaged to have varying levels of visual impact at a more localised scale.

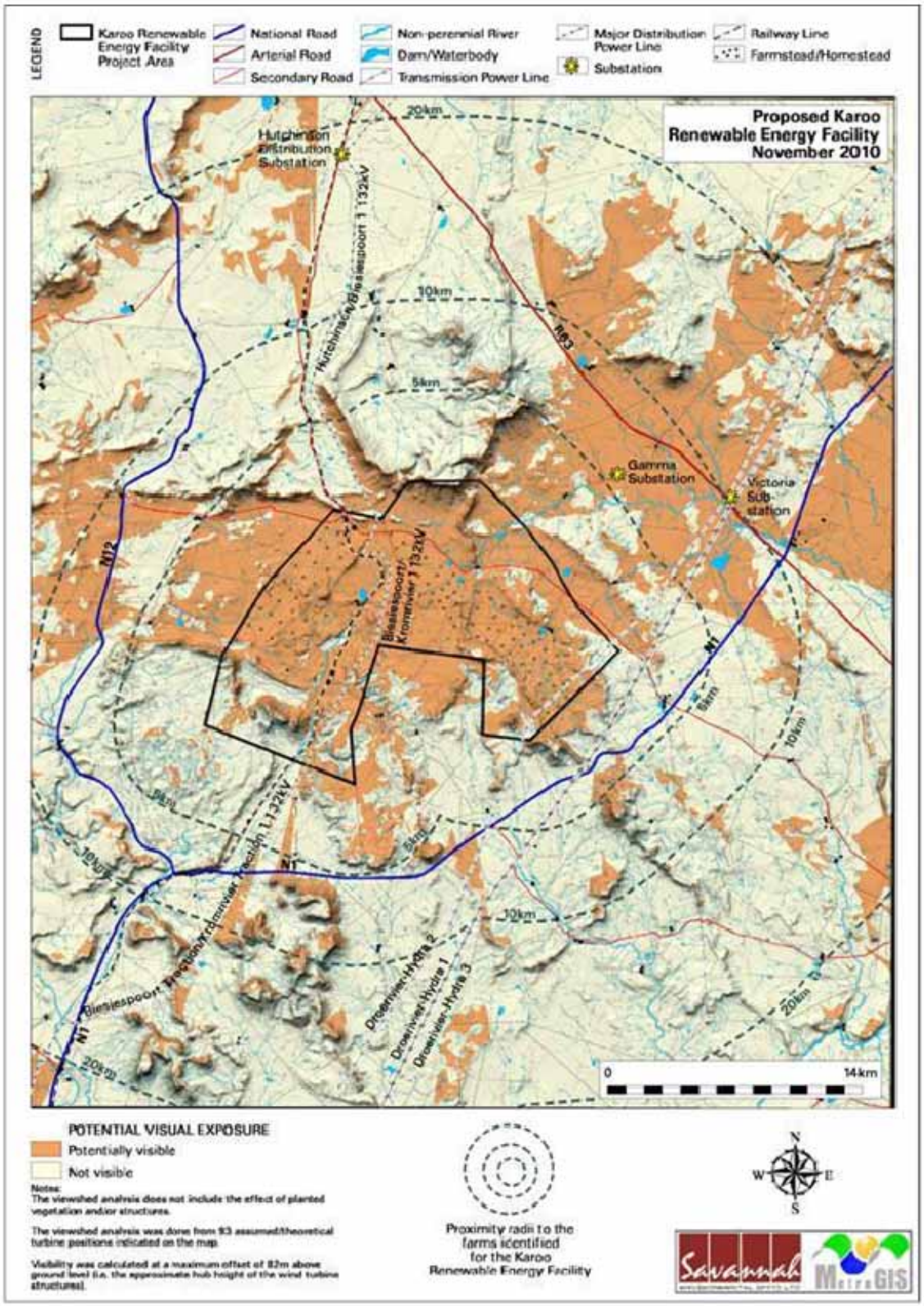

Figure 5.2: Potential visual exposure of the proposed facility illustrating areas from which any number of wind turbines (with a minimum of one turbine) may be potentially visible

Noise Impacts

Noise generated during the operational phase is mainly associated with the wind turbines, as photovoltaic systems are silent and would not contribute to noise levels in the area. Noise emitted by wind turbines can be associated with two types of noise source. These are a) aerodynamic sources due to the passage of air over the wind turbine blades and b) mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources normally have different characteristics and can be considered separately. In addition, there are other lesser noise sources, such as the substation, traffic (maintenance) as well as power line noise (known as corona).

Issue	Nature of Impact	Extent of Impact
Noise impacts	Noise impacts associated with the operation of the wind energy facility	Local

Recommendations for further study

The following work is planned for the Environmental Impact Assessment phase:

» Site visit to measure the site-specific background ambient noise levels.
» Site visit to confirm the presence of the identified receptors.
» Using the data (proposed processes, noise characteristics of the selected equipment, and preliminary locations of the wind turbines) as provided by the project developer, the predicted impact of the wind energy facility on receptors will be predicted using the CONCAWE method as stipulated by SANS 10357:2004 for the construction phase.
» The following information is required:
  * The available meteorological data,
  * An overview of the equipment, processes and schedules for the construction phase.

Impacts on the Social Environment

Based on the initial assessment of the receiving environment and the anticipated impacts associated with the wind energy and solar energy facility, it is concluded that there are no fatal flaws associated with the project at this stage. The main potential social benefits associated with the operation of the proposed Karoo Renewable Energy Facility refers to the job opportunities, the creation of “green energy” and possible socio-economic spin-offs created through the process. The majority of social impacts are of a moderate significance, but are anticipated to respond to mitigation or enhancement

measures. During the operation phase the potential exists for further, albeit limited, job creation and some skills development (positive impacts).		
Issue	**Nature of Impact**	**Extent of Impact**
Job creation	Various individuals could be employed during the operational phase of the project. They would be responsible for maintenance of the solar and/or the wind energy facility (e.g. cleaning of panels / security personnel). Capacity building and skills development throughout the life of the facility could be to the benefit of the employees and could assist them in obtaining transferable skills.	Local
Inflow of workers	The maintenance and operation of the wind energy and solar energy facilities are not deemed to result in any major change in the population size, especially if locals are permanently employed. At this stage, it is anticipated that the main impact in this regard would relate to the movement of workers from their place of residence to the site. An inflow of a very limited number of specialists on an intermittent basis is also not anticipated to have any negative impacts on the social environment.	Local
Impact on daily living and movement patterns	The impact on daily living and movement patterns during the life of the facility mainly refers to the permanent visual impact of the solar energy and wind energy facilities, as well as the associated power line, which again impacts on the character of the area and therefore on the sense of place as experienced by the residents and visitors. Lighting pollution at night is also a concern. From a social perspective, it is however, anticipated that the natural landscape (koppies) could, to some extent, screen the solar energy facility from the road users and the surrounding residents. This is, however, less so with regards to the wind energy facility.	Local
Safety and security	It is not anticipated that the operation of the proposed wind energy and solar energy facilities would have a negative impact on the safety and security of surrounding residents due to the fact that permanent security personnel would be employed and their presence in the area could even limit other possible criminal activities. As the site would be fenced, unauthorised entry to the site would be highly unlikely, thereby creating limited safety risks in this regard.	Local
Possible impact on tourism	The proposed wind energy and solar energy facilities could become a local tourism attraction, as these types of facilities are generally viewed in a positive light, mainly due to the clean technology used and overall positive impact on the environment. It could be included as an attraction in the Ubuntu Local Municipality's Tourism Strategy.	Local
Local procurement	During the operational phase local procurement for general materials, goods and services (e.g.	Local

	catering and security) could materialise.	
Impact on farming activities	It is expected that the existing farming activities undertaken on the property (sheep farming) would be able to continue in the areas not physically occupied by new infrastructure. Areas that would not be able to be utilised for farming purposes anymore would include the actual footprint of the turbine structures, the footprint of the solar mounts, access roads, fire breaks and associated buildings.	Local
Health related impacts	As the operations at the proposed facilities would not result in any air pollution, the subsequent health impacts on communities and property owners in close proximity or sensitive receptors are deemed insignificant.	Local

Recommendations for further study

The following activities will be undertaken as part of the Social Specialist Study during the EIA Phase:

» Further literature review

A comprehensive literature review and analysis would be undertaken during the EIA phase of the project. This would assist the consultants to acquire further demographic and socio-economic information with regards to the receiving environment and to build on the initial profiling of the local population's socio-economic characteristics.

» Consultation sessions and fieldwork

During the EIA Phase additional primary data would also be gathered by means of consultation with the stakeholders and affected parties, and linkages with the public participation process.

» Analysis of data compiled by parallel studies

If available, the social impact assessment team will study and analyse the information gathered by the biophysical studies. This would assist the social team to assess the impact of the proposed development on the direct (surrounding communities) and indirect (regional) environment.

» Variables to be assessed and impacts to be rated
  - Population impacts;
  - Community/institutional arrangements;
  - Conflicts between local residents and newcomers;
  - Individual and Family level impacts;
  - Community infrastructure needs; and
  - Intrusion impacts.

» Significance Criteria

* During the EIA phase, the anticipated social impacts would be rated according to a specific rating approach which would include the extent of the impact, the probability of the impact occurring, the magnitude, the duration of the impact and its significance, as stipulated by Savannah Environmental.

Impacts on Geology, Soils and Erosion Potential

The most important issues are the direct impacts of degradation and specifically accelerated erosion of soil from the area of activity. Wind erosion in disturbed areas where soil is loosened will probably be the more common form of erosion due to the low precipitation in this region. This would affect the ecosystems operating in the soil and the plant and animal species that depend on it for growth and survival.

Issue	Nature of Impact	Extent of Impact
Soil pollution	Pollution of *in situ* soil due to spillage of hazardous substances such as fuel, oil and cement	Local
Soil erosion	Loss of soil by water or wind erosion	Local
Siltation downstream/ downwind	Alteration of soil processes due to abnormal siltation arising from accelerated erosion	Regional

Recommendations for further study

» Further investigations on site can provide more details with regards to the spatial distribution of potentially erodible soils. To this end, a visual assessment of the study area should be undertaken in the EIA phase.
» Simultaneously, a basic geotechnical engineering assessment of the site should also be undertaken in the EIA phase to determine the constraints on the development which may affect the positioning of the components within the facility.
» Provide mitigating measures to input into the EMP.

Impacts on Agricultural potential and land capability

Operation related activities which could impact on the agricultural potential and land capability of the study site include loss of arable land for the duration of this phase.

Issue	Issue	Extent
Loss of arable land due	Loss of arable land, however, at the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.	Local

Recommendations for further study

It is recommended that the Environmental Impact Assessment (EIA) include a reconnaissance survey of the area to verify the deductions made from the desktop study (scoping report) and to shed light on the following:

» Soil form and distribution;
» Soil texture, structure and organic matter content (factors influencing erosion);
» Vegetative stand, surface crusting and surface particle size distribution (factors influencing dust production);
» Possible occurrence of wetland areas.

However, the abovementioned aspects will be covered by other relevant specialist studies which will be undertaken during the EIA phase. It will therefore not be necessary/relevant to undertake a survey of the site during the EIA phase in terms of Agricultural potential and land capability.

CONCLUSIONS CHAPTER 6

South African Renewable Green Energy (SARGE) is proposing the establishment of a commercial electricity generating facility to be known as the Karoo Renewable Energy Facility, which will comprise a combination of a wind energy facility component and a photovoltaic solar facility component, as well as the associated infrastructure. The facility is proposed to be established on an identified site which is located approximately 34 km south of Victoria West, in the Northern and Western Cape Provinces within the Ubuntu as well as the Beaufort West Local Municipalities. The total area for consideration within which the proposed facility will be constructed is approximately 20 222 ha (202 km^2) in extent.

The renewable energy facility is proposed to accommodate up to 350 MW which would comprise a combination of the following technologies:

» up to 150 wind turbines with a generating capacity of up to 300MW
» an array of photovoltaic (PV) panels with a generating capacity of up to 50MW

Other infrastructure associated with the facility will include:

» An on-site generator transformer and a small substation to facilitate the connection between the renewable energy facility and the Eskom electricity grid;
» Foundations to support both the turbine towers as well as the PV panels;
» Cabling between the project components, to be lain underground where practical;
» An overhead power line (132kV) of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (also known as the Biesiespoort) Substation; and
» Internal access roads; and
» Workshop area for maintenance and storage.

The Draft Scoping Report for the proposed project 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 NEMA.

This Draft Scoping Report aimed to:

» Identify the broad issues detailing the nature and extent of the proposed facility.
» Identify the potential issues associated with the proposed project.
» Define the specific studies required within the EIA.

These aims were 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 I&APs. In

accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the 'do nothing' option) have been identified for consideration within the EIA process.

The conclusions and recommendations of this Draft Scoping Report are the result of on-site inspections, desk-top evaluations of impacts identified by specialists, and the parallel process of public participation.

A summary of the conclusions of the evaluation of the proposed combined renewable energy facility is provided below. Recommendations regarding investigations required to be undertaken within the EIA are provided within the Plan of Study for EIA (refer to Chapter 7).

6.1. Conclusions drawn from the Evaluation of the Proposed Site for Development of the Karoo Renewable Energy Facility

The site that has been identified for the proposed renewable energy facility covers an area of approximately 200 km^2 which is larger than the proposed development footprint of the facility. Therefore, the facility and the associated infrastructure (including wind turbines, solar PV panels, substation, internal access roads, generator transformer and workshop area) can be appropriately placed within the larger site taking into account identified environmental constraints. This scoping study has identified areas of higher sensitivity on the larger site to assist in focusing the location of the development footprint to minimise the potential for environmental impact.

Issues identified through this scoping study as being potentially associated with the proposed facility include impacts on biodiversity and ecology, including habitat alteration and disturbance of fauna and flora during the operational phase due to regular maintenance activities, visual impacts, potential impacts on heritage sites, soil erosion, noise produced by the spinning of rotor blades; avian mortality resulting from collisions with turbine blades, solar panels and power lines and impacts on the social environment. The majority of potential impacts identified to be associated with the construction and operation of the proposed facility are anticipated to be localised and restricted to the proposed site. No environmental fatal flaws were identified to be associated with the site, and no absolute 'no-go' areas were identified for the larger 200 km^2 site. A number of potentially sensitive natural habitats and areas important for maintaining ecological processes have been identified through the environmental scoping study, however, these will be assessed in detail in the EIA phase.

The potentially significant issues related to the **construction** of the Karoo Renewable Energy facility include, *inter alia*:

» Impacts on endangered flora, terrestrial fauna, and avifauna (local and site specific)

» Soil erosion, loss or degradation
» Loss of heritage resources
» Socio-economic impacts, including both positive and negative (job creation and business opportunities, impacts associated with construction workers in the area)
» Noise emanating from construction activities.

The potentially significant issues related to the **operation** of the combined wind and solar energy facility include, *inter alia*:

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads
» Bird mortality
» Positive socio-economic impacts
» Possible noise impacts on sensitive receptors
» Soil erosion, loss or degradation

In order to connect the renewable energy facility to the power grid, an overhead power line of ~6km in length feeding into the Eskom electricity network at the existing Skietkuil (Biesiespoort) Substation situated on the farm Nobelsfontein 227, will be required to be established. Potential issues identified to be associated with the proposed overhead distribution power line include impacts on flora, fauna and ecological processes, visual impacts, impacts on avifauna as a result of collisions and electrocutions, and potential impacts on heritage sites.

The power line will be considered in detail within the EIA phase in order to assess potential impacts associated with the power line corridor and make recommendations regarding a preferred alternative alignment and appropriate mitigation measures.

A combined preliminary sensitivity map was compiled in order to indicate areas which have already been marked as potentially sensitive through the scoping studies. Figure 6.1 below indicates potentially high sensitivity ecological areas as well as potentially sensitive noise receptors in the study area. This map does not represent no-go areas but rather an outline of potentially sensitive areas identified through scoping. The map will be further refined in the EIA phase.

Understanding which area of the site would be least impacted by the development of such a facility, SARGE should prepare the detailed infrastructure layouts for consideration within the EIA phase. Through the EIA phase more detailed studies will be conducted, and further sensitive areas will be marked, more accurately and in more detail than in this Draft Scoping Report.

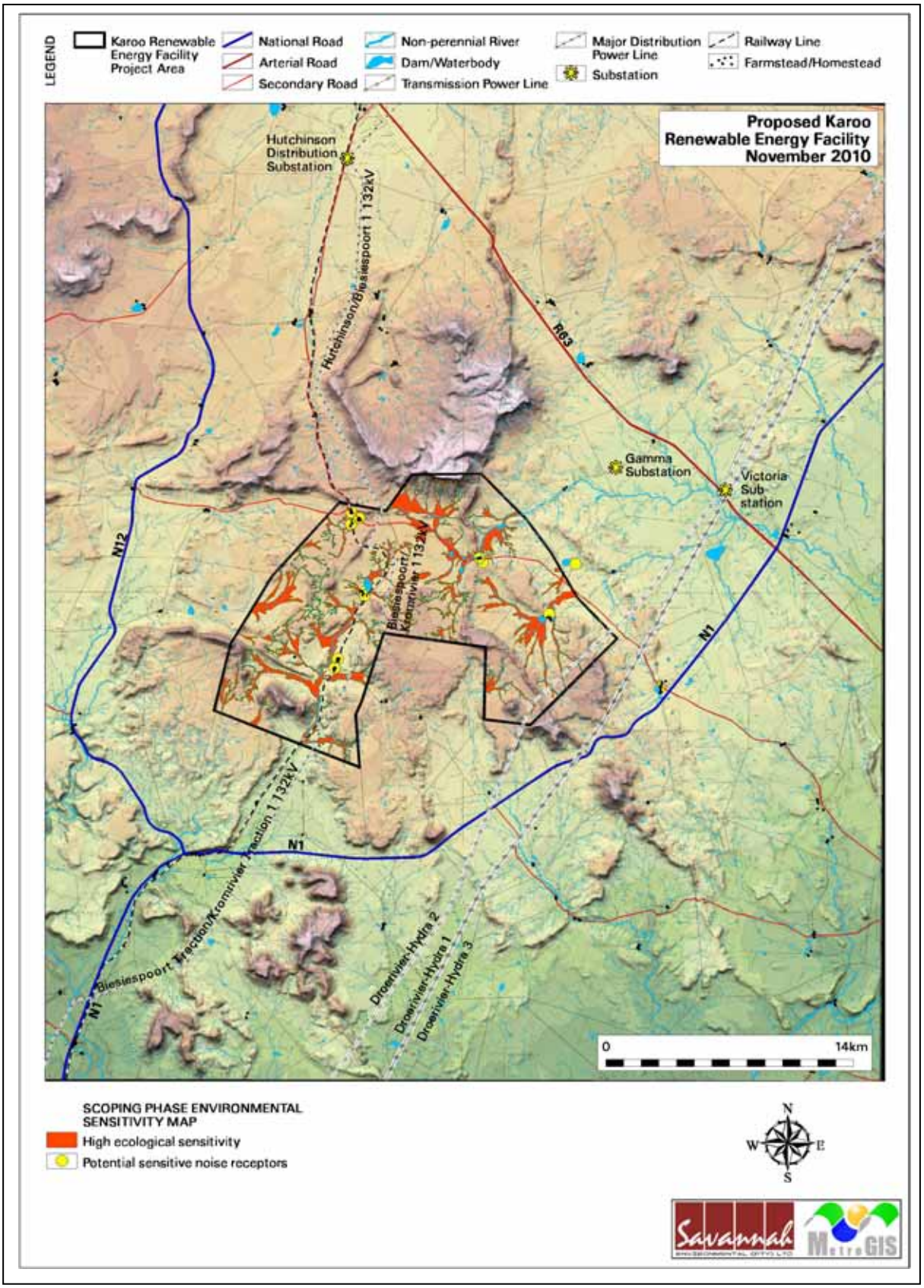

Figure 6.1: Preliminary sensitivity map indicating potentially high sensitive ecological areas as well as potentially sensitive noise receptors in the study area

PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT CHAPTER 7

This Draft Scoping Report includes a detailed description of the nature and extent of the proposed combined wind and solar energy facility with details regarding the Scoping Phase, as well as the issues identified and evaluated through the Scoping Phase (to date). This chapter provides the context for a Plan of Study for the EIA.

The Plan of Study describes how the EIA Phase will proceed and includes detailed specialist studies for those potential impacts recorded to be of significance. The key findings of the Scoping Phase includes inputs from authorities, the public, the applicant and the EIA specialist team and are used to inform the Plan of Study for EIA together with the requirements of the NEMA EIA Regulations and applicable guidelines.

7.1. Aims of the EIA Phase

The EIA Phase will aim to achieve the following:

» Provide an overall assessment of the social and biophysical environment affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed renewable energy facility and associated infrastructure.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

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

7.2. Authority Consultation

Consultation with the competent and commenting authorities (i.e. DEA, DENC and DEA&DP) has been undertaken and will continue throughout the EIA process. On-going consultation and input from these authorities will include the following:

» Submission of a Final Scoping Report following a 30-day public review period of this draft scoping report (and consideration of comments received).
» An opportunity to visit and inspect the site.
» Submission of a Final EIA Report following a 30-day public review period of the draft EIA Report.
» A consultation meeting with DEA, DENC and DEA&DP in order to discuss the findings and conclusions of the EIA Report.

7.3. Consideration of Alternatives

The following project alternatives will be investigated in the EIA:

» **The 'do nothing' alternative:** SARGE does not establish the proposed Karoo Renewable energy facility (maintain status quo).
» **Site-specific alternatives:** particularly the layout of the wind turbines, PV panels and corridors/servitudes for associated infrastructure such as the access roads and power line.
» **Alternative technologies:** for use in the establishment of the wind energy component of the facility.
» **Alternative servitudes for power line routing:** Network integration studies, planning and design for the transmission of the power generated at the solar and wind energy facility is still being finalised. This will be informed through understanding the local power requirements and the stability of the local electricity network. In order to connect the renewable energy facility to the power grid, an overhead power line feeding into the Eskom electricity network at the existing Skietkuil (Biesiespoort) Substation will be required to be established. Alternative routes/corridors for the power line will be assessed in the EIA phase

7.4. Assessment of Potential Impacts and Recommendations regarding Mitigation Measures

A summary of the issues which require further investigation within the EIA phase, as well as the proposed activities to be undertaken in order to assess the significance of these potential impacts is provided within Table 7.1. The specialists involved in the EIA Phase are also reflected in Table 7.1.

Table 7.1: Issues requiring further investigation during the EIA Phase and activities to be undertaken in order to assess the significance of these potential impacts

Issue	Activities to be undertaken in order to assess significance of impacts	Specialist
Ecology	» The presence and distribution of drainage lines on site will be confirmed. This will be done primarily using aerial photograph interpretation, but will be confirmed in the field and with reference to other specialist studies being done on site. » A detailed sensitivity map of the entire site will be produced from aerial photography during the EIA phase. This will include mapping and incorporation of any sensitive features, for example drainage lines, that may occur on site. » The presence of species of concern will be evaluated during the EIA phase. For plant species this will be done by searching for populations that could occur in the study area based on habitat requirements and historical collection records. For animal species this will be done by assessing habitat suitability for those species that have been assessed as potentially occurring in the area. The lists provided in this Draft Scoping Report will form the basis for those assessments and surveys. Particular attention will be paid to those species classified as threatened, Near Threatened or Critically rare, including one mammal species classified as Critically Endangered (the Riverine Rabbit), one Near Threatened reptile species (the Namaqua Plated Lizard) and one protected frog species (the Giant Bullfrog).	David Hoare Consulting
Avifauna	» The scoping phase has identified potential avifaunal issues associated with the proposed renewable energy facility and its associated infrastructure. These issues will be investigated in more detail during the full EIA phase. In particular, the significance of bird collisions with the turbines will be assessed in order to determine whether the risk warrants mitigation such as no-go areas for turbines or periodic shutting down of the wind turbines. This will be assessed mainly in terms of (i) the actual or estimated abundance of priority bird species in the area, and (ii) the distribution of relevant microhabitats and food resources, and the way in which the latter is likely to influence aggregation and movement of these birds through the impact zone of the proposed renewable energy facility. » The EIA phase will emphasise the outcome of the site visit, which in turn will include: (i) Absolute or sample surveys of large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance of local populations of these key taxa. (ii) Estimates of the extent and direction of possible movements of these species within/through the anticipated impact zone of the renewable energy facility, in relation	Avisense Consulting

Issue	Activities to be undertaken in order to assess significance of impacts	Specialist
	to the distribution of available resources – nesting or roosting sites (e.g. cliff-lines, wetlands, stands of trees, existing power lines) and foraging areas (e.g. wetlands, rocky screes and ridges). (iii) Identification of the least sensitive/lowest risk areas to locate wind turbines within the broader study area, in terms of (i) and (ii) above. » The results will include a more detailed assessment of all impacts, recommended mitigation where necessary (particularly with reference to the siting of turbines) and, perhaps most importantly, a comprehensive, long-term programme for monitoring actual impacts from pre- to post-construction phases of the development, and improving our understanding of the long-term effects of wind energy developments on South African avifauna.	
Erosion potential	» Conduct a site visit to confirm the physical and geological information used in this report and to collect visual information pertaining to the soil types and their geotechnical engineering properties; » Assess the present state of erosion, identify critical areas in terms of erosion and produce a map identifying these areas; » Prepare a specialist report detailing the environmental issues and potential impacts pertaining to soil degradation and erosion; » Assess the potential direct and indirect impacts using a weighting system that assigns a value to the categories (extent, duration, magnitude, probability) and arrives at a total which depicts the significance of the particular impact; » Assess the contribution of the proposed activity in the cumulative impact of the development in the area; » Comparatively assess any feasible alternatives (if any); » Provide mitigating measures to input into the Environmental Management Plan (EMP).	Outeniqua Geotechnical Services
Heritage	» A full phase 1 archaeological impact assessment will be conducted to establish the range and importance of the exposed and *in situ* archaeological heritage materials and features, the potential impact of the development and to make recommendations to minimise possible damage to these sites. » Provide mitigating measures to input into the EMP.	Albany Museum

Issue	Activities to be undertaken in order to assess significance of impacts	Specialist
Visual and aesthetics	The potential sensitive visual receptors should be identified and the severity of the visual impact assessed within the EIA phase of the project. Photo simulations of critical viewpoints should be undertaken, in order to aid in the visualisation of the envisaged visual impact. The following activities will be undertaken: » Determine Viewer Incidence/Viewer Perception The number of observers and their perception of a structure determine the concept of visual impact. » Determine the Visual Absorption Capacity (VAC) of the landscape This is the capacity of the receiving environment to absorb or screen the potential visual impact of the proposed facility. » Determine the Visual Impact Index The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur.	MetroGIS
Social	» A comprehensive literature review and analysis would be undertaken during the EIA phase of the project. This would assist the consultants to acquire further demographic and socio-economic information with regards to the receiving environment and to build on the initial profiling of the local population's socio-economic characteristics. » During the EIA Phase additional primary data would also be gathered by means of consultation with the stakeholders and affected parties, and linkages with the public participation process. » If available, the social impact assessment team will study and analyse the information gathered by the biophysical studies (e.g. information related to technical, environmental, economic and demographic aspects and land-use changes, impact on other facilities, services, and so forth) done in parallel with the public participation process and social studies. This would assist the social team to assess the impact of the proposed development on the direct (surrounding communities) and indirect (regional) environment. » The following variables would also be assessed:	Batho Earth

Issue	Activities to be undertaken in order to assess significance of impacts	Specialist
	* Population impacts * Community/institutional arrangements * Conflicts between local residents and newcomers * Individual and Family level impacts * Community infrastructure needs * Intrusion impacts » Assess these potential impacts using a weighting system that assigns a value to the categories (extent, duration, magnitude, probability) and arrives at a total which depicts the significance of the particular impact. » Prepare a specialist report detailing the potential social impacts.	
Noise	» A site visit to obtain information regarding background noise levels, the prevailing meteorological conditions during this background noise level survey, as well as confirming and identifying potential sensitive receptors. » Currently identified (potential) sensitive receptors will be investigated during the EIA phase, and any additional receptors will be identified. Their relative sensitivity to noise impacts will be determined. This will be based on the SANS 10103 guideline, as well as current land uses on the properties (residential vs business/industrial). » Using the data (proposed processes, noise characteristics of the selected equipment, and locations of the WTG) as provided by the project developer, the predicted impact of the REF on receptors will be predicted using the CONCAWE method as recommended by SANS 10357:2004 for both the construction and operational phases. » Using the calculated noise levels at the identified sensitive receptors, the projected significance of the REF (whether construction or operational) will be determined using the criteria as proposed (subject to possible changes after any stakeholder input).	M2 Environmental Connections

7.5. Methodology for the Assessment of Potential Impacts

Direct, indirect and cumulative impacts of the above issues, as well as all other issues identified will be assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional:
  * Local extending only as far as the development site area – assigned a score of 1;
  * Limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
  * Will have an impact on the region – assigned a score of 3;
  * Will have an impact on a national scale – assigned a score of 4; or
  * Will have an impact across international borders – assigned a score of 5.
» The **duration**, wherein it will be 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 shall describe the likelihood of the impact actually occurring. Probability will be 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 shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.

» The **status**, which will be 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 SARGE has the responsibility to avoid and/or minimise impacts as well as plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts will be discussed. Assessment of mitigated impacts will demonstrate the effectiveness of the proposed mitigation measures.

The results of the specialist studies and other available information will be integrated and synthesised by the Savannah Environmental project team. The EIA Report will include:

» **Detailed description** of the proposed activity
» A description of the property(ies) on which the activity is to be undertaken and the location of the activity on the property(ies)
» A description of the **environment that may be affected by the activity** and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity
» Details of the **public participation process** conducted, including:
  * Steps undertaken in accordance with the plan of study for EIA;
  * A list of persons, organisations and Organs of State that were registered as interested and affected parties;

- A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response to those comments; and
- Copies of any representations, objections and comments received from registered interested and affected parties

» A description of the **need and desirability** of the proposed project and identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity
» An indication of the methodology used in determining the **significance** of potential environmental impacts
» A description and comparative **assessment of all alternatives** identified during the environmental impact assessment process
» A summary of the findings and recommendations of **specialist reports**
» A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
» An assessment of each identified potentially significant impact
» A description of any assumptions, uncertainties and gaps in knowledge
» an environmental **impact statement** which contains:
- A summary of the key findings of the environmental impact assessment; and
- A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives

» A draft **environmental management plan**
» Copies of specialist reports

The Draft EIA Report will be released for a 30-day public review period. The comments received from I&APs will be captured within a Comments and Response Report, which will be included within the Final EIA Report, for submission to the authorities for decision-making.

7.6. Public Participation Process

A public participation process will be undertaken by **Batho Earth** in conjunction with Savannah Environmental. Consultation with key stakeholders and I&APs will be on-going throughout the EIA Phase. Through this consultation process, stakeholders and I&APs will be encouraged to identify additional issues of concern or highlight positive aspects of the project, and to comment on the findings of the EIA Phase. In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities will be provided for stakeholders and I&APs to be involved in the EIA Phase of the process, as follows:

» Focus group meetings
» Public meetings (pre-arranged and stakeholders invited to attend).
» One-on-one consultation meetings (for example with directly affected and surrounding landowners).
» Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
» Written, faxed or e-mail correspondence.

The Draft EIA Report will be made available for public review for a 30-day period prior to finalisation and submission to the DEA for review and decision-making. In order to provide an overview of the findings of the EIA process and facilitate comments, a public meeting will be held during this public review period.

7.7. Key Milestones of the Programme for the EIA

The envisaged key milestones of the programme for the EIA Phase are outlined in the following table.

Key Milestone Activities	Proposed timeframe
Public review period for Draft Scoping Report	16 November 2010 – 15 December 2010
Finalisation of Scoping Report and submission to DEA	December 2010
Authority acceptance of the Final Scoping Report and Plan of Study to undertake the EIA	January 2010
Undertake specialist studies and public participation process	January 2010 - February 2010
Make Draft EIA Report and Draft EMP available to the public, stakeholders and authorities	February 2010
Finalisation of EIA Report	February 2010
Submit Final EIA Report to DEA for review and decision-making	March 2010

REFERENCES CHAPTER 8

Ecology, Flora and Fauna

BARNES, K.N. (ed.) (2000) The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

BRANCH, W.R. (1988) South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.

DENT, M.C., LYNCH, S.D. & SCHULZE, R.E. 1989. Mapping mean annual and other rainfall statistics in southern Africa. Department of Agricultural Engineering, University of Natal. ACRU Report No. 27. Massachusetts: Clark University.

DRIVER, A., MAZE, K., ROUGET, M., LOMBARD, A.T., NEL, J., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K and STRAUSS, T. 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

DU PREEZ, L. & CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Random House Struik, Cape Town.

FAIRBANKS, D.H.K., THOMPSON, M.W., VINK, D.E., NEWBY, T.S., VAN DEN BERG, H.M & EVERARD, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. *S.Afr.J.Science* 96: 69-82.

FRIEDMANN, Y. & DALY, B. (eds.) 2004. The Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

GERMISHUIZEN, G., MEYER, N.L., STEENKAMP, Y and KEITH, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book - Butterflies. *South African National Scientific Programmes* No. 158, Foundation for Research Development, CSIR, Pretoria.

IUCN (2001). *IUCN Red Data List categories and criteria: Version 3.1*. IUCN Species Survival Commission: Gland, Switzerland.

MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. S. Afr. J. Agric. Extension, 3(3): 1-4.

MILLS, G. & HES, L. 1997. The complete book of southern African mammals. Struik Publishers, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. and KLOEPFER, D. (eds.) 2004. Atlas and Red Data Bookof the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

MUCINA, L. AND RUTHERFORD, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C. AND POWRIE, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome.* In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

PASSMORE, N.I. & CARRUTHERS, V.C. (1995) South African Frogs; a complete guide. Southern Book Publishers and Witwatersrand University Press. Johannesburg.

RUTHERFORD, M.C. & WESTFALL, R.H. (1994). Biomes of southern Africa: an objective categorization. *Memoirs of the Botanical Survey of South Africa* No. 63.

VAN WYK, A.E. & SMITH, G.F. 2001. Regions of floristic endemism in southern Africa. Umdaus press, Hatfield.

WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNISO vegetation map of Africa. Natural Resources Research 20. Unesco, Paris.

Avifauna

Acha, A. 1997. Negative impact of wind generators on the Eurasian Griffon *Gyps fulvus* in Tarifa, Spain. *Vulture News* 38:10-18.

Altwegg, R. & Anderson, M.D. 2009. Rainfall in arid zones: possible effects of climate change on the population ecology of blue cranes. Functional Ecology 23: 1014-1021.
Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Avian Powerline Interation Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington DC.

Barclay, R.M.R, Baerwald, E.F. & Gruver, J.C. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. *Canadian Journal of Zoology* 85: 381-387.
Barrios, L. & Rodríguez, A. 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. *Journal of Applied Ecology* 41: 72-81.
Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa, Johannesburg.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. *Ibis* 136: 412-425.

Bevanger, K. 1995. Estimates and population consequences of Tetraonid mortality caused by collisions with high tension power lines in Norway. *Journal of Applied Ecology* 32: 745-753.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electric power lines. *Biological Conservation* 86: 67-76.

Bright, J., Langston, R., Bullman, R. Evans, R., Gardner, S., & Pearce-Higgins, J. 2008. Map of bird sensitivities to wind farms in Scotland: A tool to aid planning and conservation. *Biological Conservation* 141: 2342-2356.

Crockford, N.J. 1992. A review of the possible impacts of wind farms on birds and other wildlife. Joint Nature Conservation Committee. JNCC Report number 27. Peterborough, United Kingdom.

Curry, R.C., & Kerlinger, P. 2000. Avian mitigation plan: Kenetech model wind turbines, Altamont Pass WRA, California. In: Proceedings of the National Avian-Wind Power Planning Meeting III, San Diego California, May 1998.

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

Devereaux, C/L., Denny, M.J.H. & Whittingham, M.J. 2008. Minimal effects of wind turbines on the distribution of wintering farmland birds. *Journal of Applied Ecology* 45: 1689-1694.

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

Drewitt, A.L. & Langston, R.H.W. 2008. Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Science* 1134: 233-266.

Erickson, W.P., Johnson, G.D., Strickland, M.D., Young, D.P., Sernka, K.J., Good, R.E. 2001. Avian collisions with wind turbines: a summary of existing studies and comparison to other sources of avian collision mortality in the United States. National Wind Co-ordinating Committee Resource Document.

Erickson, W.P., Johnson, G.D., Strickland, M.D., Kronner, K. & Becker, P.S. 1999. Baseline avian use and behaviour at the CARES Wind Plant Site, Klickitat County, Washington. Unpublished report to the National Renewable Energy Laboratory. NREL, Colorado.

Everaert, J. 2003. Wind turbines and birds in Flanders: Preliminary study results and recommendations. *Natuur. Oriolus* 69: 145-155.

Farfán, M.A., Vargas, J.M. & Duarte, J. 2009. What is the impact of wind farms on birds. A case study in southern Spain. *Biodiversity Conservation* 18: 3743-3758.

Gill, J.P., Townsley, M. & Mudge, G.P. 1996. Review of the impact of wind farms and other aerial structures upon birds. *Scottish Natural Heritage Review* 21.

Gunerhan, H., Hepbasli, A. & Giresunli, U. 2009. Environmental impacts from the solar energy systems. *Energy Sources, Part A: Recovery, Ulilization and Environmental Effects* 31: 131-138.

Hanowski, J.M., & Hawrot, R.Y. 2000. Avian issues in development of wind energy in western Minnesota. In Proceedings of the National Avian-Wind Power Planning Meeting III, San Diego California, May 1998.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Hodos, W. 2002. Minimization of motion smear: Reducing avian collisions with turbines. Unpublished subcontractor report to the National Renewable Energy Laboratory. NREL/SR 500-33249.

Howell, J.A. 1995. Avian mortality at rotor sweep areas equivalents Altamont Pass and Montezuma Hills, California. Prepared for Kenetech Wind Power, San Francisco, California.

Janss, G. 2000a. Bird behaviour in and near a wind farm at Tarifa, Spain: Management considerations. In: Proceedings of National Avian-Wind Power Planning Meeting III, San Diego California, May 1998.

Janss, G.F.E. 2000b. Avian mortality from power lines: a morphologic approach of a species-specific mortality. *Biological Conservation* 95: 353-359.

Jaroslow, B. 1979. A review of factors involved in bird-tower kills, and mitigation procedures. In: G.A. Swanson (Tech co-ord). The Mitigation symposium. A national workshop on mitigation losses of Fish and Wildlife Habitats. US Forest Service General Technical Report. RM-65.

Jenkins, A.R. 2001. The potential impact of a demonstration wind farm facility on the birds of the Darling / Yzerfontein area, Western Cape Province, South Africa. Unpublished report to the Environmental Evaluation Unit, University of Cape Town, Cape Town.

Jenkins, A.R. 2003. Populations and movements of priority bird species in the vicinity of the proposed Darling Demonstration Wind Farm facility. Unpublished report to the Environmental Evaluation Unit, University of Cape Town, Cape Town.

Jenkins, A.R. 2008a. A proposed new list of the threatened raptors of southern Africa. Gabar 19 (1): 27-40.

Jenkins, A.R. 2008b. Eskom generation wind energy facility – Western Cape: Avifaunal impact assessment. Report to Savannah Environmental Pty (Ltd).

Jenkins, A.R. 2009. Hopefield wind energy facility: avifaunal impact assessment. Report to Savannah Environmental Pty (Ltd).

Jenkins, A.R. 2010. Specialist input to proposed Cookhouse Wind Energy Facility: focal site review. Report to Savannah Environmental Pty (Ltd).

Jenkins, A.R., de Goede, J.H. & van Rooyen, C. 2007. Improving the products of the Eskom Electric Eagle Project. Unpublished report to Eskom.

Jenkins, A., Gibbons, B. & Visagie, R. 2009. Long-term fixed site monitoring of wildlife interactions with power lines across a range of biomes: establishment and maintenance of a long-term bird;power line interaction monitoring site in the De Aar (Hydra) area of the eastern Karoo, Northern Cape. Unpublished report to Eskom.

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. *Bird Conservation International* 20: 263-278.

Kemper, C.A. 1964. A tower for TV: 30 000 dead birds. *Audubon Magazine* 66: 86-90.

Kerlinger, P. & Dowdell, J. 2003. Breeding bird survey for the Flat Rock wind power project, Lewis County, New York. Prepared for Atlantic Renewable Energy Corporation.

King, D.I. & Byers, B.E. 2002. An evaluation of powerline rights-of-way as habitat for early-successional shrubland birds. *Wildlife Society Bulletin* 30: 868-874.

Kingsley, A. & Whittam, B. 2005. Wind turbines and birds – A background review for environmental assessment. Unpublished report for Environment Canada/Canada Wildlife Service.

Krijgsveld, K.L., Akershoek, K., Schenk, F., Dijk, F. & Dirksen, S. 2009. Collision risk of birds with modern large wind turbines. *Ardea* 97: 357-366.

Küyler, E.J. 2004. The impact of the Eskom Wind Energy Demonstration Facility on local avifauna – Results from the monitoring programme for the time period June 2003 to Jan 2004. Unpublished report to Eskom Peaking Generation.

Kuvlevsky, W.P. Jnr, Brennan, L.A., Morrison, M.L., Boydston, K.K., Ballard, B.M. & Bryant, F.C. 2007. Wind energy development and wildlife conservation: challenges and opportunities. *Journal of Wildlife Management* 71: 2487-2498.

Larsen, J.K. & Guillemette, M. 2007. Effects of wind turbines on flight behaviour of wintering common eiders: implications for habitat use and collision risk. *Journal of Applied Ecology* 44: 516-522.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: a global review. *Biological Conservation* 136: 159-174.

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

Masden, E.A., Fox, A.D., Furness, R.W., Bullman, R. & Haydon, D.T. 2009. Cumulative impact assessments and bird/wind farm interactions: Developing a conceptual framework. *Environmental Impact Assessment Review* 30: 1-7.

McIsaac, H.P. 2001. Raptor acuity and wind turbine blade conspicuity. Pp. 59-87. National Avian-Wind Power Planning Meeting IV, Proceedings. Prepared by Resolve, Inc., Washington DC.

Mucina. L. & Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
National Wind Co-ordinating Committee. 2004. Wind turbine interactions with birds and bats: A summary of research results and remaining questions. Fact Sheet, Second Edition.

Newton, I. & Little, B. 2009. Assessment of wind-farm and other bird casualties from carcasses found on a Northumbrian beach over an 11-year period. *Bird Study* 56: 158-167.

Noguera, J.C., Pérez, I. & Mínguez, E. 2010. Impacts of terrestrial wind farms on diurnal raptors: developing a spatial vulnerability index and potential vulnerability maps. *Ardeola* 57: 41-53.

Pennycuick, C.J. 1989. Bird flight performance: a practical calculation manual. Oxford University Press, Oxford.

Pierce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. 2009. The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, Published Online, September 24, 2009.

Richardson, W.J. 2000. Bird migration and wind turbines: Migration timing, flight behaviour and collision risk. In Proceedings of the National Avian-wind Power Planning Meeting III, San Diego, California, May 1998.

Scottish National Heritage. 2005. Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Unpublished Report.

Shaw, J., Jenkins, A.R. & Ryan, P.G. 2010a. Modelling power line collision risk in the Blue Crane *Anthropoides paradiseus* in South Africa. *Ibis* 152: 590-599.

Shaw, J., Jenkins, A.R., Ryan, P.G. & Smallie, J. 2010b. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. *Ostrich* 81: 109-113.

Stewart, G.B., Pullin, A.S. & Coles, C.F. 2007. Poor evidence-base for assessment of windfarm impacts on birds. *Environmental Conservation* 34: 1-11.

Smallie, J. & Strugnell, L. 2010. African Clean Energy Developments (Pty) Ltd Cookhouse Wind Energy Facility – Eastern Cape: Avifaunal impact assessment. Report by the EWT to Savannah Environmental Pty (Ltd).

Smallwood, K.S. & Thelander, C. 2008. Bird mortality in the Altamont Pass Wind Resource Area, California. *Journal of Wildlife Management* 72: 215-223.

Smallwood, K.S., Rugge, L. & Morrison, M.L. 2009. Influence of behavior on bird mortality in wind energy developments. *Journal of Wildlife Management* 73: 1082-1098.

Sovacool, B.K. 2009. Contextualizing avian mortality: a preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity. *Energy Policy* 37: 2241-2248.

Tapia, L., Dominguez, J. & Rodriguez, L. 2009. Using probability of occurrence to assess potential interaction between wind farms and a residual population of golden eagle *Aquila chrysaetos* in NW Spain. *Biodiversity & Conservation* 18: 2033-2041.

Tsoutsos, T., Frantzeskaki, N., Gekas, V. 2005. Environmental impacts from solar energy technologies. *Energy Policy* 33: 289-296.

Van Rooyen, C. 2001. Bird Impact Assessment Study – Eskom Wind Energy Demonstration Facility, Western Cape South Africa. Prepared for Eskom Enterprises, TSI Division.

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

Weir, R. D. 1976. Annotated bibliography of bird kills at manmade obstacles: a review of the state of the art and solutions. Canadian Wildlife Services, Ontario Region, Ottawa.

Walker, D., McGrady, M., McCluskie, A., Madders, M. & McLeod, D.R.A. 2005. Resident Golden Eagle ranging behavior before and after construction of a windfarm in Argyll. *Scottish Birds* 25: 24-40.

Winkelman, J.E. 1995. Bird/wind turbine investigations in Europe. In Proceedings of the National Avian- wind Power Planning Meeting 1994.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.D. & Colahan, B.D. (eds). 2003. Big birds on farms: Mazda CAR report 1993-2001. Avian Demography Unit, Cape Town.

Geology and Erosion Potential

1:250 000 Geological map 3122 Victoria West (1991). Council for Geoscience, Pretoria.

Brink, A.B.A. (1979) Engineering Geology of South Africa (Series 1-4). Building Publications, Pretoria.

Identification of Problematic Soils in Southern Africa (2007). Technical notes for civil and structural engineers. Published by the Department of Public Works.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria.

National Department of Environmental Affairs website (www.environment.gov.za).

National Department of Water Affairs website (www.dwaf.gov.za).

SACS (1980). Stratigraphy of South Africa. Handbook 8, Geological Survey, Department of Mineral and Energy Affairs, Government Printer, 690pp.

South African Weather Service website (www.weathersa.co.za).

Wienert, H. H. (1980). The Natural Road Construction Materials of Southern Africa. H&R Academia Publ., Pretoria, 298pp.

Soil an Agricultural Potential

Land Type Survey Staff. 1972 – 2006. Land Types of South Africa: Digital map (1:250 000 scale) and soil inventory databases. ARC-Institute for Soil, Climate and Water, Pretoria.

MacVicar, C.N. et al. 1977. Soil Classification. A binomial system for South Africa. Sci. Bull. 390. Dep. Agric. Tech. Serv., Repub. S. Afr., Pretoria.

MacVicar, C.N. et al. 1991. Soil Classification. A taxonomic system for South Africa. *Mem. Agric. Nat. Resour. S.Afr.* No.15. Pretoria.

Visual

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral maps and digital data.*

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Northern Cape Province (ENPAT Northern Cape).*

Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Western Cape Province (ENPAT Western Cape).*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Scenic Landscape Architecture (2006). *Cullerin Range Wind Farm; Visual Impact Assessment.* Unpublished Report.

Heritage

Anderson, E. nd. The history of the Xhosa in the Northern Cape. Rhodes University Thesis.

Beaumont, P. B. & Morris, D. 1990. Guide to archaeological sites in the Northern Cape. Kimberly: McGregor Museum.

Beaumont, P.B. & Vogel, J.C. 1984. Spatial patterning of the Ceramic Later Stone Age in the Northern Cape Province, South Africa. In: Hall, M.; Avery, G.; Avery, D. M.; Wilson, M. L. & Humphreys, A. J. B. *Frontiers: southern African archaeology today*. Oxford: BAR International Series 207.

Binneman, J.; Booth, C. & Higgitt, N. 2010. A phase 1 archaeological impact assessment (AIA) for the proposed Skietkuil Quarries 1 and 2 on the Farm Skietkuil No. 3, Victoria West, Central Karoo District, Western Cape Province.

Deacon, H.J. & Deacon, J. 1999. *Human Beginnings in South Africa*. Cape Town: David Philip.

Gess, W.H.R. 1969. Excavations of a Pleistocene bone deposit at Aloes near Port Elizabeth. *South African Archaeological Bulletin* 24:31-32.

Green, L. G. 1955. *Karoo*. Cape Town: Howard Timmins.

Goodwin, A. J. H. 1926. The Victoria West Industry. In: Goodwin, A.J.H. & van Riet Lowe, C. (eds). *The South African Cultures of South Africa*. Annals of the South African Museum.

Goodwin, A.J.H. 1946. Earlier, Middle and Later. *South African Archaeological Bulletin*, Vol. 3 (1): 74-76.

Lycett, S.J. 2009. Are Victoria West cores "proto-Levallois"? A phylogenetic assessment. *Journal of Human Evolution*, Vol 56: 175-199.

Morris, D. 1988. Engraved in place and time: a review of variability in the rock art of the Northern Cape and Karoo. *South African Archaeological Bulletin*, Vol. 43: 109-121.

Morris, D. 2006. Revised archaeological specialist input for the proposed Hydra-Gamma 765kV transmission lines along the (existing) 400kV corridor near De Aar and Victoria West, Northern Cape Province.

Morris, D. & Beaumont, P. B. 1990. Renosterkop: an archaeological impact assessment at the site of the proposed Trans Hex Tin Mine, Kakamas District, South Africa. Unpublished report submitted to Trans Hex Group Ltd and the National Monuments Council, November 1990.

Parkington, J.; Morris, D. & Rusch, N. 2008. *Karoo Rock Engravings*. Cape Town: Creda Communications.

Rosenthal, E. 1959. *One Hundred Years of Victoria West 1859-1959*. Cape Province: Municipality of Victoria West.

Sampson, C. G. 1985. *Atlas of Stone Age Settlement in the Central and Upper Seacow Valley*. Memoirs van die Nasionale Museum Bloemfontein, Vol. 20: 1-116.

Sharon, G. 2009. Acheulian Giant-Core Technology. *Current Anthropology*, Vol. 50 (3): 335-367.

Shearing, T. & Shearing, D. 2000. *General Smuts and His Long Ride*. Anglo-Boer War Commemoration, Cape Commando Series No. 3. Cape Town: Mills Litho.

Smith, R. A. 1919. Recent finds of the Stone Age in Africa. *Man*, Vol. 19: 100-106.

The London Gazette, February 18, 1902: 1036.

Thompson, E. & Marean, C. W. 2008. The Mossel Bay lithic variant: 120 years of Middle Stone Age Research from Cape St. Blaize Cave to Pinnacle Point. South Africa Archaeological Society Goodwin Series, Vol. 10: 90-104.

Noise

Norton, M.P. and Karczub, D.G.: Fundamentals of Noise and Vibration Analysis for Engineers, Second Edition, 2003

SANS 0103:2004. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.

SANS 0210:2004. 'Calculating and predicting road traffic noise'.

SANS 10328:2003. 'Methods for environmental noise impact assessments'.

SANS 0357:2004 The calculation of sound propagation by the Concave method'.

The Assessment and Rating of Noise from Wind Farms: Working Group on Noise from Wind Turbines, September 1996 – ETSU-97.

Social

Beaufort West Municipality (2010). Review of the Integrated Development Plan 2010/2011.

Becker, H.A. (1997). Social Impact Assessment: Method and experience in Europe, North America and the developing world. UCL Press: London

Becker, H.A. & Vanclay, F. (eds) (2003). The International Handbook of Social Impact Assessment: Conceptual and Methodological Advances. Edward Elgar: Cheltenham

BKS (Pty) Ltd. (2004). Beaufort West Municipality: Spatial Development Framework Volume 1: Development Profile

Burdge, R.J. A community guide to Social Impact Assessment
Creative Harvest. (2009). Ubuntu Tourism Strategy: A ten year plan (2010 until 2020).

Finsterbusch, K., Llewellyn, L.G. & Wolf, C.P. (eds) (1983). Social Impact Assessment Methods. Sage Publications: Beverly Hills

Pixley ka Seme District Municipality (2010). Summary of the Integrated Development Plan for 2010/2011 Financial Year

Savannah Environmental. (2010). Background Information Document for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern Cape Province

Statistics South Africa. (2008). Statistical Release: Basic Result Municipalities of Community Survey of 2007

Ubuntu Municipality. (2009). Integrated Development Plan 2009/2010.

www.beaufortwestmun.co.za

www.beaufortwestsa.co.za

www.demarcation.org.za

www.northerncape.gov.za

www.northerncape.org.za

www.pixleykasemedm.co.za

www.ubuntu.gov.za