ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT EIA REPORT

PROPOSED TSITSIKAMMA COMMUNITY WIND ENERGY FACILITY

EASTERN CAPE PROVINCE
(DEA Ref No: 12/12/20/2209)

DRAFT FOR PUBLIC REVIEW
SEPTEMBER 2011

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PROJECT DETAILS

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Title	:	Environmental Impact Assessment Process Draft EIA Report: Proposed Tsitsikamma Community Wind Energy Facility, Eastern Cape Province
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Project Developer	:	Exxaro Resources Ltd
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PURPOSE OF THE DRAFT EIA REPORT

Exxaro Resources Ltd and Watt Energy (Pty) Ltd are currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind energy facility in the Tsitsikamma area of the Eastern Cape. Exxaro Resources and Watt Energy have 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 EIA Scoping Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

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

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

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

INVITATION TO COMMENT ON THE EIA SCOPING REPORT

Members of the public, local communities and stakeholders are invited to comment on the Draft Scoping Report which has been made available for public review and comment at the following locations from **16 September 2011 to 17 October 2011**:

Clarkson Library	Kareedouw Library
www.savannahSA.com	

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

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

PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA report and provide feedback on the findings of the studies undertaken, a public feedback meeting will be held during the review period for the Draft EIA Report as follows:

» **Date:** 22 September 2011
» **Time:** 18:00
» **Venue:** Clarkson Community Hall, Clarkson

EXECUTIVE SUMMARY

Background and Project Overview

Exxaro Resources Ltd and Watt Energy (Pty) Ltd, both potential independent producers of electricity, are proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Kouga Local Municipality in the Eastern Cape Province. The proposed wind energy facility will be known as the Tsitsikamma Community Wind Farm and is proposed to be constructed on land partly owned by the Tsitsikamma Community Trust. The proposed site is situated approximately 30 km west of Humansdorp, south of the N2 National Road in the Tsitsikamma area. Wind turbines with a capacity of up to 100 MW, collectively referred to as a wind energy facility, are planned to be constructed over an area of approximately 54 km2 in extent. These will be appropriately spaced to make use of the wind resource on the site.

Associated infrastructure proposed includes:

» **31 Wind Turbines** with a total generating capacity of ~100 MW
» **Foundations** to support the turbine towers
» Underground **cables** between turbines
» A **substation** (25 x 25 m) within the development site
» An overhead **power line** (i.e. 132 kV distribution line) which will link to the existing Eskom Melkhout Substation ~ 25 km northeast of the proposed site or Diep Rivier Substation ~ 8 km north of the site
» Internal **access roads** (up to 6m wide) to each wind turbine.
» Workshop / administration building (100m^2)

The identified site (as assessed in this draft scoping report) for the establishment of the proposed Tsitsikamma Community Wind Energy Facility is situated within the Eastern Cape Province approximately 10km northwest of Oyster Bay, 20 km west of Humansdorp and approximately 30 km east of Kareedouw (~3817 ha in and includes following farm portions:

» Portions 19 and 22 of Zalverige Valley 660;
» Portions 3 and 5 of Vergaaderingskraal 675;
» Portion 1 of Ou Driefontein 721;
» Portion 2 of New Driefontein 720;
» Portions 3 - 9 of Wittekleibosch 787;
» Farm 818;
» Remainder of Farm 678; and
» Portion 3 of Kliprug 676.

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

The proposed Tsitsikamma Community Wind Energy Facility project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998).

Environmental Impact Assessment

In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GN R543 (Regulations 26-35) and R545, a Scoping Study and EIA are required to be undertaken for this proposed project.

The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by DEA (under Application Reference number **12/12/20/2209**). Through the decision-making process, the DEA will be supported by the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA).

Through the Scoping Phase, although no environmental fatal flaws or absolute 'no-go' areas were identified, a number of **potentially sensitive areas** were identified. These included areas of agricultural land within centre pivot irrigation systems; high sensitivity ecological areas; potentially sensitive noise receptors within the study area and potential heritage sites within the area. A number of issues and potentially sensitive areas requiring further study for both the wind energy facility development site as well as the associated infrastructure were highlighted. These issues have been assessed in detail within the EIA Phase of the process (refer to Chapter 6).

The EIA phase aimed to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed wind 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&AP are afforded the opportunity to participate in the EIA process, and that their issues and concerns are recorded.

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

EIA Recommendations & Conclusions

In summary, the conclusions of the impact assessment are as follows:

» Overall the proposed wind energy facility is likely to have a **medium-low** local and regional negative impact on the **ecology** on site, prior to mitigation. This could be reduced to **low after mitigation**. The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation in development footprints, and direct, long-term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. during the construction phase. A number of impacts associated with this project are due to the fact that some of the infrastructure is proposed to be positioned close to wetlands & watercourses. A slight shifting in the positions of these turbines (specifically turbine 8, 17 and 25) will minimise this potential impact.

» The primary concern for the proposed facility in terms of **avifauna** will be that of collision of birds with the turbines and earth wires of the power line. This impact on avifauna is potentially of **medium - high** significance, but could be reduced to a **medium - low significance** with the implementation of mitigation measures. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended (and outlined in the avifauna specialist study), from pre-construction into the operational phase of the project.

» The findings of the **geology and soils** study indicate the most important impacts on geology and soils include soil degradation (including erosion). The geological setting is not typically prone to erosion but minor erosion will occur in areas where run-off is concentrated. The significance of the main direct impacts that have been identified is considered **low to moderate** due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. An assessment of the potential geotechnical constraints on the project indicates no insurmountable problems which have may have an impact on the design and construction processes. Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary degradation of soil. Special attention to be given to roads that cross drainage lines.

» The **agricultural potential and land use** study indicated that the project could have impacts on indentified highly sensitive areas. The significance of this impact was rated as being **low** if

turbines are shifted out of high sensitivity areas (specifically turbines no 8, 17 and 25).

» The results of the **heritage** survey suggest that the impacts associated with turbine and other infrastructure footprints would have a **negligible impact** on the archaeological material in the study area. Impacts on **fossil** material are potentially of **moderate** significance. A Phase 1 field assessment study by a professional palaeontologist is recommended to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development. This will decrease the significance of this potential impact to **low**.

» It is envisaged that the structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing at homesteads or visiting the region), especially within a 5 to 10 km radius (i.e. at short to medium distances) of the facility and would constitute a high visual prominence, potentially resulting in a **high visual impact**. This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure. Furthermore this impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres such as Jeffrey's Bay, Sea Vista and Oyster Bay.

» The potential for **noise impact** on surrounding areas (outside of the development footprint) is of **low significance**. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of **medium significance** on two of the identified sensitive receptors, but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a **low** significance. Care must be taken to ensure that the operations at the wind energy facility do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

» The majority of the potential **negative impacts on the social environment** as a result of the construction and operation of the wind energy facility are expected to be of **moderate to low significance**, with implementation of the recommended mitigation measures. A number of **positive impacts** have been identified, which could be further enhanced if managed effectively.

No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However a number of impacts of high

significance requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix O. The most significant environmental impacts associated with the proposed project, as identified through the EIA, include:

» Impacts on land use and agricultural potential
» Visual impacts on the natural scenic resources of the region imposed by the components of the facility (most specifically the turbines)
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the access roads, substation and power line.
» Impacts on the social environment.

The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed by the components of the facility. The facility is likely to be visible for up to 10km from the site. The highest frequency of potential visual exposure is on the site itself and on the coastal plain to the immediate west and east of the site. The areas lying above the plateau to the north are mostly screened by the high-lying topography.

The agricultural potential of the site is directly linked to the soils. In the cases where irrigation infrastructure has been established the potential of the soils increases to high. The agricultural use on site is currently limited to grazing with improved pastures under irrigation as well as plantations.

The wetlands identified during the aerial photograph interpretation are more extensive than other drainage features. Most of the wetlands within the agricultural areas have been impacted severely but a few areas still appear relatively intact. The presence of pastures and cattle production has already lead to significant impact on the site relating to erosion and sediment generation and eutrophication. Some of the turbines are situated on the edge of potential wetland zones and could be excluded once a dedicated wetland delineation study has been conducted.

For the development of the wind energy facility, the overall soil impacts are expected to be relatively low for the shallow soil zones but will be very high for areas with established irrigation infrastructure. Impacts are generally restricted to small areas around the turbine foundation as well as the transmission and road infrastructure. Erosion control measures will have to be implemented to prevent and

contain erosion associated with soil surface disturbance due to construction activities. Some of the turbines are situated on the edge of potential wetland zones and could be required to be relocated once a dedicated wetland delineation study has been conducted.

In order to reduce potential impacts on sensitive areas it is suggested that:

» Planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should be used as far as possible for providing access to proposed turbine positions. Road infrastructure and cable alignments should coincide as much as possible.
» As a precaution, a preconstruction survey for *Protea coronata* should be undertaken at the location of the turbines (and access roads to turbines) 1, 2 and 3 to determine whether this species occurs within the footprint of the infrastructure or not. Exxaro Resources and Watt Energy should undertake a pre-construction walk-through survey of the servitude of the selected power line route to determine whether any individuals of plant species of concern occur there or not.
» Turbine 8 should be moved 30 m westwards along the existing access track and turbine 25 should be moved 20 m south-west of its current position.
» The workshop area, any interim construction facilities and temporary laydown areas should located away from any identified sensitive areas
» A wetland delineation study should be conducted to further define wetland zones on site. Wetland areas should be considered no-go areas for development of wind turbines. Where these cannot be avoided, a water use license will be required to be obtained from the Department of Water Affairs.
» Existing roads should be used as far as possible. Where new roads are required, these should be planned taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
» A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area be implemented to cover the pre-construction environment as well as the operational phase of the project (Appendix H and Appendix O).
» The developer must consider the various mitigation options as suggested in the noise EIA assessment (Appendix M) to reduce the significance of the potential noise impact on any

sensitive receptors to an impact of lower significance.

It is clear that all options for the proposed power line will be highly visible although areas of visual screening occur in areas of undulating topography and along incised river valleys. In order of preference, Option A is favoured from a visual perspective followed by Option C. Option B is considered the least favourable.

The following infrastructure would be included within an authorisation issued for the project:

» Construction of the Wind Energy Facility with up to **31 wind turbine units**, and all **associated infrastructure** (access roads to site, internal access roads, workshop building)
» Construction of a single **substation** on the site.
» **Overhead power line** (of up to 132kV) linking the wind energy facility to the Eskom electricity distribution network via the existing Diep Rivier Substation as proposed in Figure 7.1 to follow the proposed **Option A** route. Alternatively to follow proposed **Option B** route to Melkhout substation if connection to Diep Rivier is not feasible.

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

» Mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.
» The draft Environmental Management Plan (EMP) as contained within Appendix O of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Disturbed areas should be rehabilitated as quickly as possible once construction in an area is completed, and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Mitigate secondary visual impacts associated with the construction of roads through the use of existing roads wherever possible.
» A monitoring program should be initiated in order to collect data on the numbers of birds and bats affected by the wind energy facility.
» The developer should consider the various mitigation options as

proposed in the noise assessment to reduce the significance of the potential noise impact on any sensitive receptors. Should the layout (or type of wind turbines used) change significantly during the final design, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.

» The final location of the wind turbines and associated infrastructure must be informed by surveys undertaken by an ecological, avifaunal and heritage specialist. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.

» The positions of turbines 8, 17 and 25 should be revised to avoid sensitive areas on wetlands / watercourses. It is suggested that a wetland delineation study is conducted to further refine areas of sensitivity. If turbines are found to be located in areas of high sensitivity their positions should be revised.

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

» A preconstruction survey for *Protea coronata* should be undertaken at the location of the turbines (and access roads to turbines) 1, 2 and 3.

» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.

» A Phase 1 field assessment study by a professional palaeontologist is recommended to identify any palaeontological hotspots and make specific recommendations for any mitigation required.

» An on-going monitoring programme should be established to detect, quantify and control any alien plant species within the project site.

» A comprehensive stormwater management plan should be compiled for the facility footprint prior to construction.

» Applications for all other relevant and required permits required to be obtained by Exxaro Resources and Watt Energy and must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any riparian vegetation or wetlands.

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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.

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.

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

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

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

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn

the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

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

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 80 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

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

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
D	Diameter of the rotor blades
DEDEA	Eastern Cape Department of Economic Development and Environmental Affairs
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, Ordinance 15 of 1985
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)
OTB	Overberg Test Base
SAAO	South African Astronomical Observatory
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

INTRODUCTION *CHAPTER 1*

Exxaro Resources Ltd and **Watt Energy** (Pty) Ltd, both potential independent producers of electricity, are proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Kouga Local Municipality in the Eastern Cape Province. The proposed wind energy facility will be known as the **Tsitsikamma Community Wind Farm** and is proposed to be constructed on land partly owned by the Tsitsikamma Community Trust. The proposed site is situated approximately 30 km west of Humansdorp, south of the N2 National Road in the Tsitsikamma area. Wind turbines with a capacity of up to **100 MW**, collectively referred to as a **wind energy facility**, are planned to be constructed over an area of approximately 54 km^2 in extent. These will be appropriately spaced to make use of the wind resource on the site.

Based on an extensive pre-feasibility analysis and site identification process undertaken, as well as an analysis of the wind resource in the area, a favourable area has been identified for consideration and assessment as per the requirements of an Environmental Impact Assessment (EIA). The site being considered for the proposed wind energy facility covers an area of approximately 54 km^2 which has primarily been used for agricultural activities. This site is proposed to accommodate wind turbines with a generating capacity of up to 100 MW as well as the associated infrastructure which is required for such a facility, i.e.
:

- Up to **31 Wind Turbines** (with a hub height of up to 100m) with a total generating capacity of ~100 MW
- **Foundations** (of up to 15 x 15 x 3 m) to support the turbine towers
- Underground cables between turbines
- A **substation** (covering an area of up to 25m x 25m) within the development site
- An overhead **power line** (i.e. 132 kV distribution line) which will link to the existing Eskom Melkhout Substation ~ 25 km northeast of the proposed site
- Internal **access roads** (of up to 6m wide) to each wind turbine.
- **Main access road / haul road** to the site
- Workshop / administration building

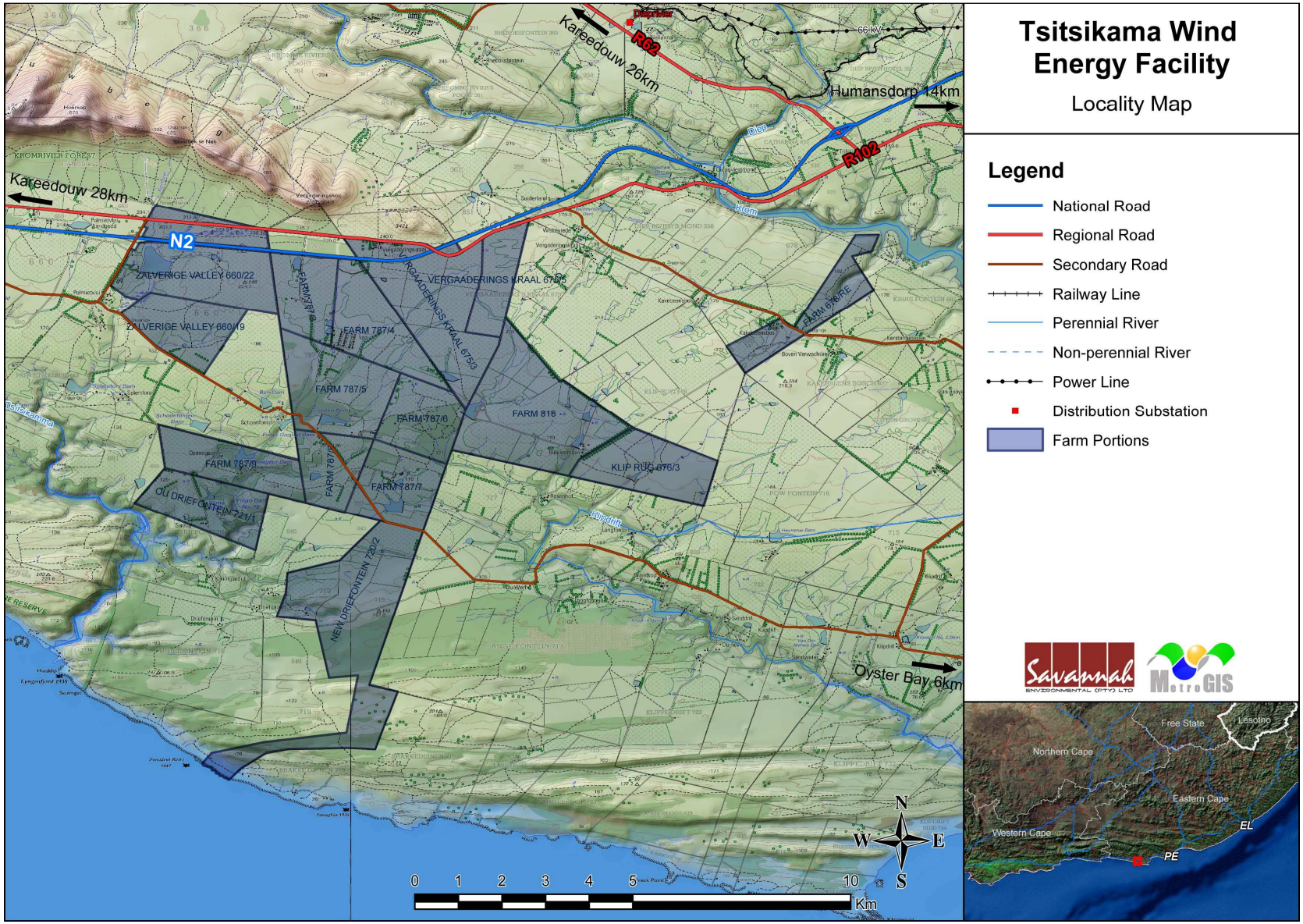

Figure 1.1: The location of the proposed development site for the Tsitsikamma Community Wind Energy Facility

1.1 Requirement for an EIA Process

In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Exxaro Resources and Watt Energy require authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Eastern Cape Department of Economic Affairs, Environment and Tourism) for the construction and operation of the proposed Wind Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GN R543 (Regulations 26-35) and R545, a Scoping Study and EIA are required to be undertaken for this proposed project. The following activities are listed in terms of GN R544 and R545 (June 2010):

Relevant Notice	Activity No	Description of listed activity
GN 545, 18 June 2010	1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.
GN 545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 ha or more.
GN 544, 18 June 2010	10 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts
GN 544, 18 June 2010	11	The construction of: (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
GN 544, 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.
GN 544, 18 June 2010	23(ii)	The transformation of undeveloped, vacant or derelict land to residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares except where such transformation takes place for linear activities.

In order to obtain authorisation, comprehensive, independent environmental studies must be undertaken in accordance with the EIA Regulations. This project has been registered with the National DEA under application reference number **12/12/20/2209**.

An EIA is an effective planning and decision-making tool. It allows the potential environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed. It provides the opportunity for the developer to be fore-warned of potential environmental issues such that these can be considered in the facility design, and allows for resolution of the issue(s) reported on in the EIA report as well as dialogue with I&APs.

Exxaro Resources and Watt Energy have appointed Savannah Environmental, as the independent environmental consultant, to undertake the required Scoping Study and Environmental Impact Assessment to identify and assess all the potential environmental impacts associated with the proposed project, and propose appropriate mitigation and management measures in an Environmental Management Programme (EMP). As part of these environmental studies, I&APs will be actively involved through the public involvement process being undertaken by Sustainable Futures ZA.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project.

1.2 Objectives of the EIA Process

The Scoping Phase of the EIA process, which preceded this current EIA Phase, **identified** a range of potential issues associated with the proposed project. The Scoping Phase also defined the extent of the studies required within this EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialists with experience in EIAs for similar projects, and a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs). The Scoping Phase was completed in August 2010 with the acceptance of the Final Scoping Report and Plan of Study for the EIA Phase by DEA.

The EIA Phase **assesses** those identified potential significant environmental impacts and benefits (direct, indirect, and cumulative impacts) associated with all phases of the project including design, construction, operation, and decommissioning, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA phase aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a Draft EIA Report for public review provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process to date have been captured and adequately considered. This review period also provided further opportunity for additional key issues for consideration to be raised. Following the 30 day review period, this Final EIA Report will be submitted to DEA for review and acceptance. This final report incorporate all issues and responses raised during the public review period as part of a Comments and Response Report.

1.3 Structure of this EIA Report

The EIA Report consists of eight chapters, which include:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.
Chapter 2: Provides an overview of the proposed project.
Chapter 3: Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
Chapter 4: Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5: Describes the existing biophysical and socio-economic environment.
Chapter 6: Presents the assessment of environmental impacts associated with the proposed facility and associated power line alternatives.
Chapter 7: Presents the conclusions of as well as an impact statement on the proposed project.
Chapter 8: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

1.4 The Environmental Assessment Practitioner

Savannah Environmental was contracted as the independent **Environmental Assessment Practitioner** (EAP) to undertake the EIA process for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Exxaro Resources or Watt Energy in any way. Furthermore, Savannah Environmental does not have any interests in secondary developments that could 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 Savannah Environmental team have considerable experience in 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 a number wind and solar energy facilities, throughout South Africa. John von Mayer, the principle author of this Scoping Report has four years experience in the environmental field and has gained experience in undertaking environmental studies for a wide variety of projects throughout South Africa, with focus on projects in the renewable energy sector. He has authored 8 reports for wind energy facilities.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments. Refer to Appendix A for the curricula vitae for Savannah Environmental and the specialist sub-consultants.

» Ecology, flora and fauna – David Hoare Consulting
» Avifauna – Avisense Consulting
» Geology, soils, and erosion potential – Outeniqua Geotechnical Services
» Agricultural Potential – Terrasoil
» Heritage resources – Eastern Cape Heritage Consultants
» Palaeontology – Natura Viva
» Noise – MENCO
» Visual – MetroGIS
» Social – Tony Barbour Environmental Consulting and Research

SCOPE OF THE PROPOSED PROJECT CHAPTER 2

This chapter of the EIA report provides background to the proposed wind energy facility. The following information is presented:

» Wind energy as a power generation technology.
» Details regarding the scope of the proposed project. The scope of project includes construction, operation and decommissioning activities.
» A description of the identified alternatives with regards to the proposed wind energy facility development, including the "do nothing" option.

2.1. Turning Wind into Electricity

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. The use of wind for electricity generation is a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its lifecycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production. Operation does not produce any type of air pollution, as would be associated with fossil fuel power sources. Wind energy is one of the fastest growing electricity generating technologies and features in energy plans worldwide.

As part of the feasibility phase of a proposed wind energy project, a wind resource measurement and analysis programme must be conducted for the site proposed for development, as only measured data from the proposed development site will provide a robust prediction of the facility's expected energy production over its lifetime. As such, Exxaro Resources and Watt Energy are currently conducting wind measurement monitoring on the proposed development site to measure the wind potential (wind energy) in the area. The aim of this wind measurement monitoring is to obtain reliable information about the speed, strength, direction, and frequency of the wind resource.

Wind speed is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (~12.5 m/s to 17 m/s). Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. Typical annual wind speeds range from 15 km/hr to 25 km/hr (4 m/s to 7 m/s) around South Africa's southern, eastern and western coastlines. This relates to an expected annual energy utilisation factor of between 15% and 30%, the value depending on the specific site selected.

Turbines are able to operate at varying wind 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 and 17 m/s).

Wind power (strength and frequency) is a measure of the energy available in the wind and the ability to convert the wind energy into electricity using wind turbines.

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

Although modern wind turbines are able to yaw to the direction of the wind, the design of a wind energy facility is sensitive to the predominant wind directions and wind speeds for the site, as well as to topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow), and the effect of adjacent turbines on wind flow and speed (specific spacing is required between turbines in order to reduce the effects of wake turbulence).

As the performance of the turbines is determined by disturbances to the wind resource, they must be appropriately spaced within the facility. Turbines would, therefore, be positioned within the study area of approximately 54 km^2. 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 typical 2 MW capacity turbine whose rotors are approximately 90 m in diameter, each turbine would be separated by approximately 180 m to 300 m. The erection of turbines in parallel rows one behind another would require a distance between rows of 500 m to 700 m.

The overall aim of the design and layout of the facility is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, as well as social and environmental impacts. A viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria), and the micro-siting of the turbines on the site determined using industry standard software systems, which automatically consider the spacing requirements. A final layout will still be developed prior to construction which will consider the findings of the EIA.

2.2.1. Main Components of a Wind Turbine

Generally a wind turbine consists of **three rotor blades** and a **nacelle** mounted at the top of a tapered **tower** (refer to Figure 2.1). The mechanical power generated by the

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

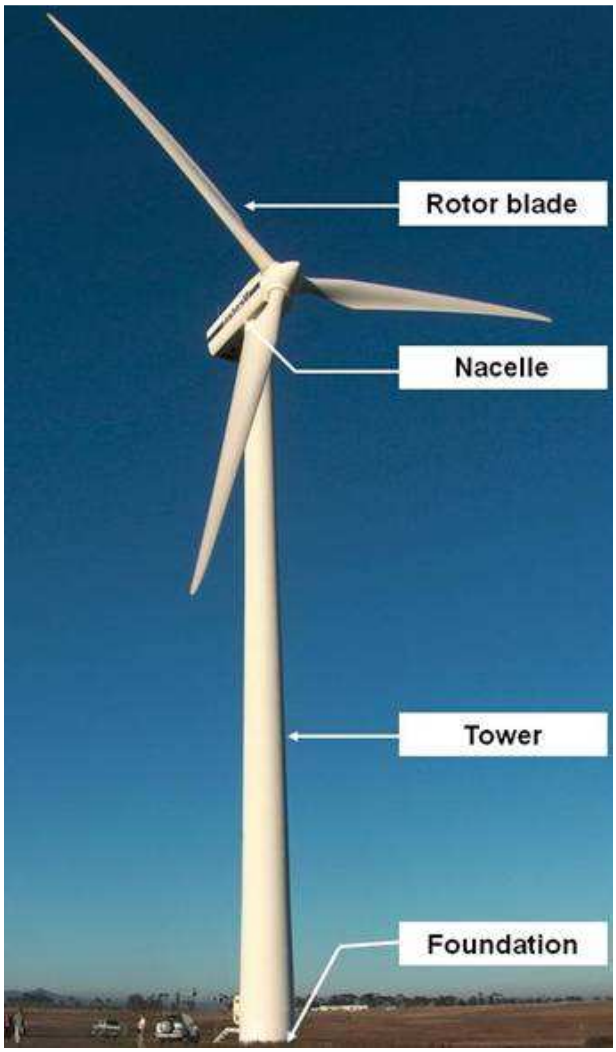

Figure 2.1: Illustration of the main components of a wind turbine

The turbines being considered for use at the proposed Tsitsikamma Community Wind Energy Facility will each be up to **3 MW** in capacity. The turbines will have a maximum **hub height** of up to **100m**.

Other infrastructure associated with the facility includes:

» foundations to support the turbine towers;
» underground cables between turbines;
» an on-site substation;
» an overhead 132kV power line linking to Eskom's existing Melkhout substation;
» internal access roads to each wind turbine;
» an access road to the site from the main road; and
» warehouse / administration building

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 generally has three blades that rotate at a constant speed up to 24 revolutions per minute (rpm). The speed of rotation of the blades is controlled by the nacelle, which can turn, so that the blades 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 gearbox and generator can be heard within a short distance of the turbine. The moving parts can be heard when the nacelle is rotating to face the wind.

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 refers to the structure that houses all the generator components , i.e. control equipment, gearbox and anemometer for monitoring the wind speed and direction (as shown in Figure 2.2). The rotor is attached to the nacelle.

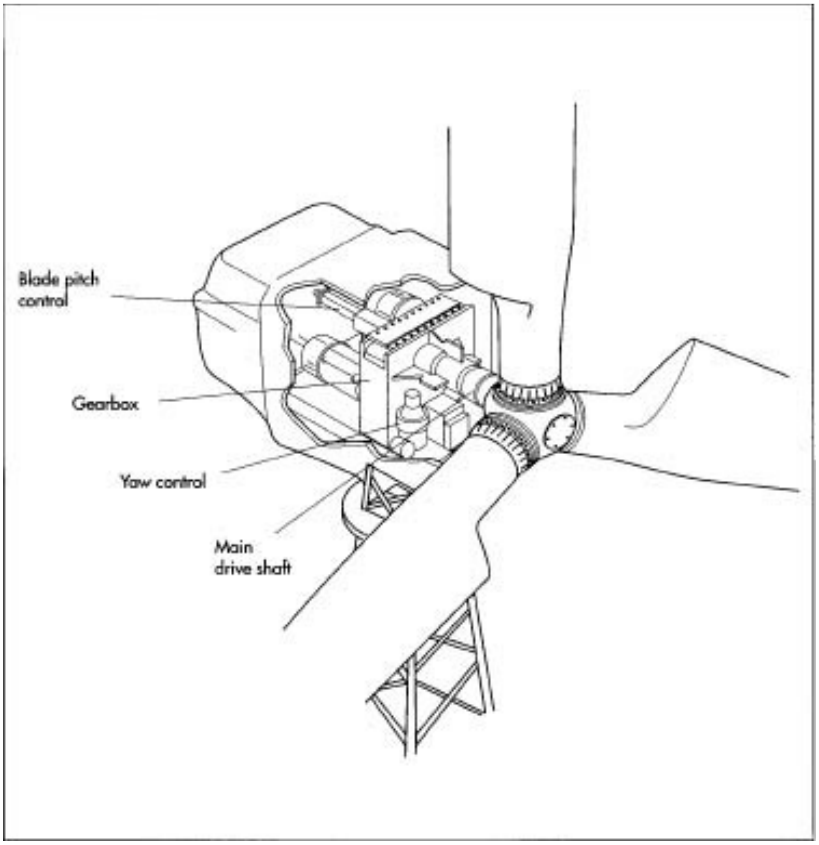

Figure 2.2: Detailed structure of a typical nacelle of a wind turbine

The generator

The generator converts the turning motion of a wind turbine's blades into electricity. Inside this component, coils of wire are rotated in a magnetic field to produce electricity. The generator's rating, or size, usually corresponds to the length of the wind turbine's blades because more energy is captured by longer blades.

The tower

The tower, which supports the rotor, is constructed from tubular steel. The tower will be up to 80 m in height, depending on the turbine type selected for the wind energy facility. The nacelle is 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.

Foundation

A concrete **foundation** is laid into the ground at the base of the turbine to provide stability and support to the turbine. The dimensions of these foundations are generally a

maximum of 15 m x 15 m wide and up to 3 m deep depending on the geotechnical properties at the footprint for the individual turbine.

2.2.2. Operating Characteristics of a Wind Turbine

With the exception of downtime for preventative maintenance and/or malfunctions, the turbines will operate 365 days a year and 24 hours a day. A turbine is designed to operate continuously, unattended and with low maintenance for 20- 30 years. The turbines will generate electricity only during times of sufficient wind.

Once operating, a wind energy facility can be monitored and controlled remotely, with a mobile team for maintenance, when required. Downtime for preventive maintenance and/or malfunctions may reduce the operating hours.

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

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

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

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

2.2. Project Site Selection

2.2.1. Identification of the Proposed Site as Suitable for Wind Energy Development

A number of sites within the broader Tsitiskamma area were considered and evaluated by Exxaro and Watt Energy against specific criteria, which included grid connectivity, land availability, the wind resource and environmental risks. Exxaro Resources and Watt Energy consider the proposed development site as a technically feasible location for a wind farm due to the favourable wind resource, having land tenure and the existing relationship Watt Energy has with the Tsitsikamma Development Trust and local community, who will stand to benefit from the construction and operation of the proposed wind energy facility.

The farms owned by the Tsitsikamma Development Trust (i.e. Wittekleibosch farms) form part of 19 farms purchased in 1994 by the Department of Land Affairs on behalf of the Mfengu tribe as a result of a successful land claim, who were forcibly removed from the area in 1977. The Mfengu comprises four communities of which Wittekleibosch is one. This project is seen as a potential community upliftment project and is being conducted in close consultation with the Tsitsikamma Development Trust.

Wind resource data is currently being collected from an existing wind monitoring mast installed on the site, which indicates a suitable wind resource for operation of a wind energy facility on the proposed site.

2.2.2. Regional Site Suitability

At a regional level, portions of the proposed development site fall within an area identified as being highly preferred for development in terms of the Regional Assessment Methodology developed by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)[1] (refer to Figure 2.3). The methodology is intended to be used as a tool for regulating wind energy developments in the Western Cape Province through an effective method of determining appropriate locations for such projects based on a combined "criteria based" and "landscape based" assessment method. Although this methodology was devised specifically for the Western Cape it includes guidelines for site selection that may also be applicable to the Eastern Cape Province. The use of this methodology in confirming the environmental suitability of a site for wind energy development in terms of identified criteria has become considered to be a best practice approach.

A key step in the generation of the final output map compiled through the application of this methodology (refer Figure 2.3) is the merging of positive and negative criteria

[1] Refer to the Western Cape DEA&DP 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. Note similar methodology is not currently available for the Eastern Cape.

relating to technical and environmental 'thresholds' with landscape issues related to visibility, landform and land cover.

These maps represent the separate composite overlays of all positive and negative criteria based map layers included within the landscape based assessment layers. As demonstrated in the DEA&DP Report (May, 2006), the merging of these layers is an effective tool in ensuring that landscape issues are considered as central to the identification of "exclusion" or "restricted" zones, (via negative landscape criteria) or "inclusion" or "preferred" zones (via positive landscape criteria). The table below indicates the possible combinations that resulted in the preferred areas for development index that is displayed in the map legend.

No.	Description	Preference
1	Areas with more than 1 negative criteria	Highly Constrained
2	Areas with one negative criteria	Constrained
3	Neutral areas (no positive or negative criteria)	Negotiable
4	Areas with one positive criteria (and no negative criteria)	Preferred
5	Areas with more than one positive criteria (and no negative criteria)	Highly preferred

The results of this process have served to confirm that, with regards to the selection of the proposed site for this project, portions of the study area are considered potentially suitable for development from an environmental and planning perspective. Sensitivities identified through the Regional Assessment process are mostly due to the presence of wetlands and rivers on the site and in the surrounding area.

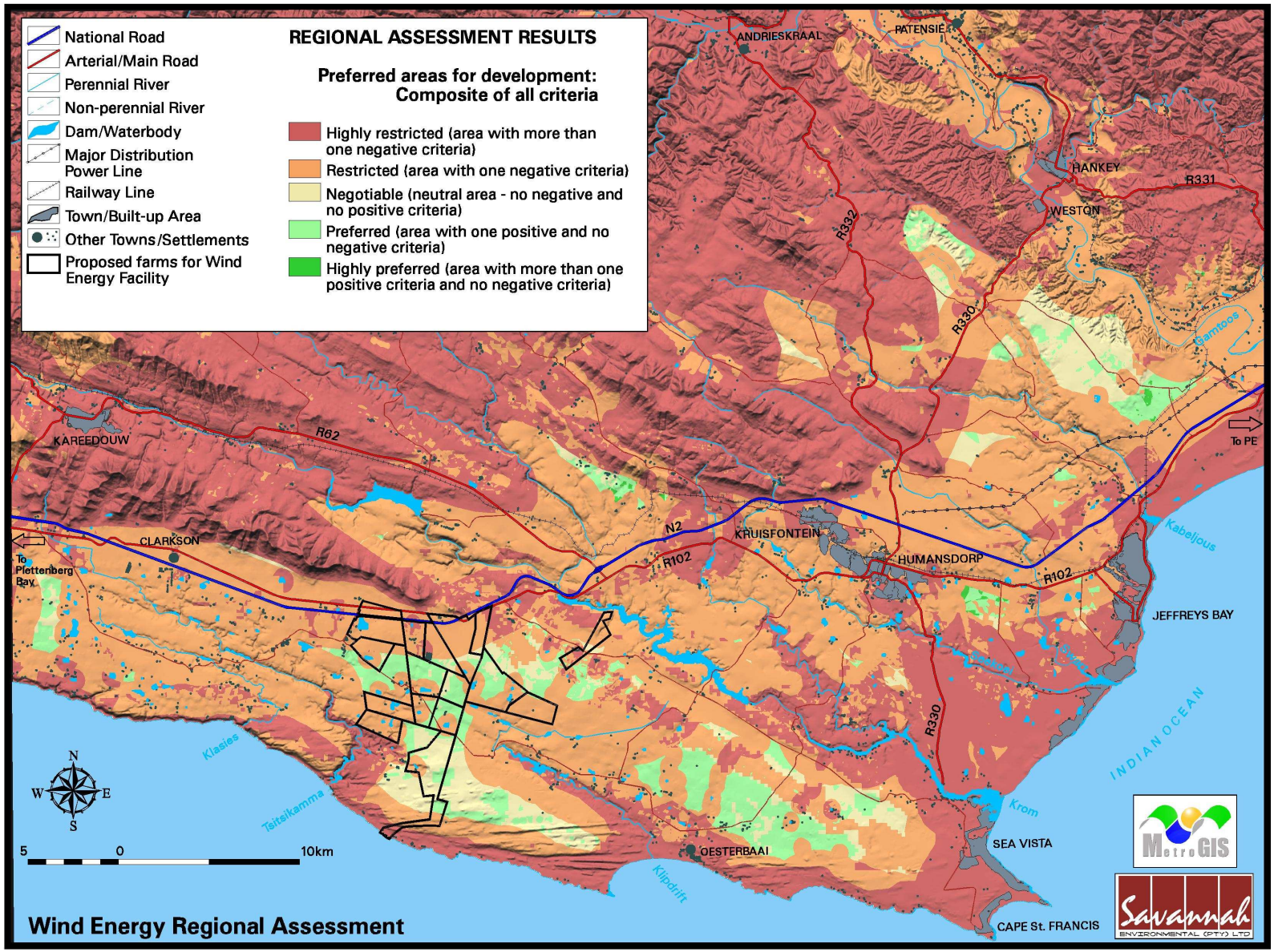

Figure 2.3: Final output map from the site screening process illustrating the results from the merging of positive and negative criteria relating to technical and environmental 'thresholds' for the site originally being considered for development.

Based on the outcomes of the regional assessment and the developer's site identification process, the proposed site has been considered to be potentially feasible for the development of a wind energy facility and has been taken forward into an EIA process, where site-specific studies and assessments can be undertaken. No feasible site alternatives have been identified. Therefore, site alternatives are not assessed within this EIA process.

2.3. Site-specific or Layout Design Alternatives

As local level issues were not assessed prior to this draft EIA report, these issues are now being considered within the site-specific studies and assessments through the EIA in order to delineate areas of sensitivity within the broader development area. Exxaro Resources and Watt Energy have not selected the turbine model or models that will be installed on the site. The capacity of the actual turbines to be used for the project is not certain at this point, but the units are expected to be up to 3 MW in capacity. The turbines will have a hub height of up to 100 m, and a rotor diameter of up to 100 m (i.e. each blade up to 50 m in length).

The site under consideration is approximately 54 km^2 in extent. Less than 20% of this area will be permanently transformed as a result of the proposed wind energy facility. As such, the placement of the wind turbines and associated infrastructure within the site can be undertaken taking cognisance of the identified environmental sensitivities. In order to identify potential sensitivities associated with a proposed layout, a **preliminary layout** of the components of the wind energy has been developed by Exxaro and Watt Energy for assessment in the EIA phase (Figure 2.4). This layout is considered to be approximately 80% accurate, and takes the findings of the scoping study into consideration. Once any site-specific environmental constraining factors have been determined through the EIA process, and more detailed site-specific wind data is available from the wind monitoring on site, the layout of the wind turbines and associated infrastructure can be appropriately finalised. The final layout will result in a carefully achieved balance of energy production and environmental protection.

Initial studies on network integration have shown the project to be viable. Network integration studies, planning and design for the distribution of the power generated by the wind energy facility are being finalised. The ability of the distribution network to absorb the generated power is one of a number of constraints on the size of the wind farm. This will be informed through understanding the local power requirements and the capacity/stability of the local electricity network, as will be determined by Eskom through a detailed grid connection study. It is proposed to link the wind energy facility to the electricity grid via Eskom's existing Melkhout substation, approximately 25 km northeast of the proposed site.

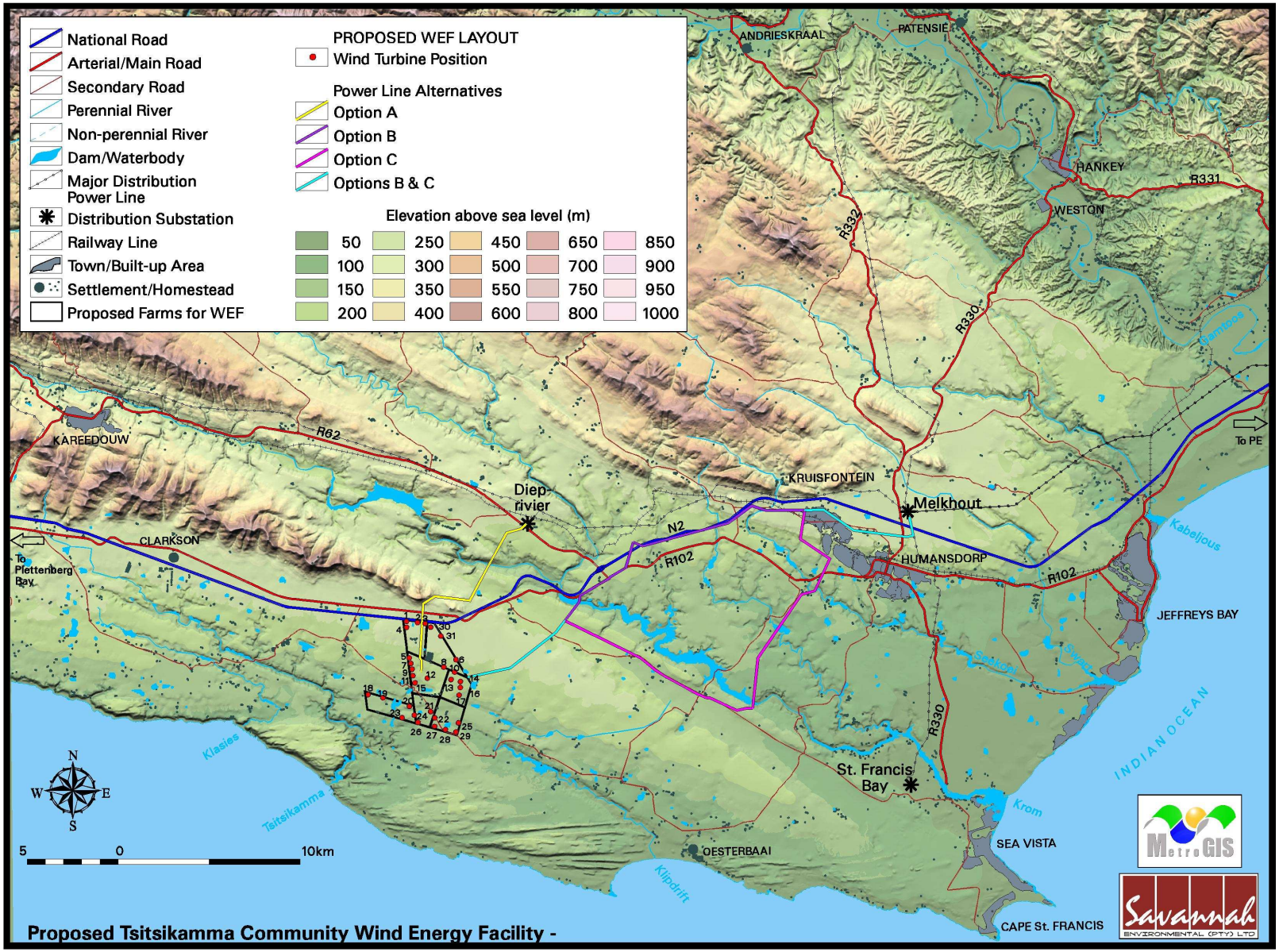

Figure 2.4: Preliminary layout for the proposed Tsitsikamma Community Wind Energy Facility indicating turbine positions and power line route alternatives (Refer to Appendix P for A3 map).

Three alignment alternatives are under consideration for this power line (figure 2.4):

» **Option A** exits the site on its northern boundary and runs north, crossing over the N2 and the R102. Thereafter it turns to the east to connect with the national grid at the Diep Rivier Distribution Substation. The length of this option is approximately 12 km. **However** Diep Rivier Substation cannot currently receive voltages as high as the 132 kV that would be received from the proposed wind energy facility. Option A can only be utilised in the event of the Diep Rivier Substation being upgraded in order to receive the higher voltage current that would be generated by the facility.

  In the event that the Diep Rivier substation is not upgraded Option B or Option C to Eskom's existing larger Melkhout Substation will be required to be utilised.

» **Option B** exits the site on its north eastern boundary and runs to the north east until it reaches the N2. It follows the alignment of the N2 for some distance, turning to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is approximately 30 km.

» **Option C** exits the site on its north eastern boundary and runs to the north east for about 5km before turning to the south east. Some 10km further on, the alignment bends back to the north east before it turns sharply to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is approximately 38,5 km.

2.4. The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of Exxaro Resources and Watt Energy not constructing the Tsitsikamma Community Wind Energy Facility. This would result in no impacts on the environment as a result of a wind energy facility in this area.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10,000 GWh renewable energy contribution to final energy consumption by 2013. The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DoE's macroeconomic study of renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, has established that the achievement of this target would provide a number of

economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20,500 new jobs. In addition, the development of renewable energy beyond the 10,000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. There is therefore a need for additional electricity generation options to be developed throughout the country. The option to do nothing in terms of implementing renewable energy projects therefore effectively means the choice to build another form of power generation plant in another location. This would most likely be a coal-fired thermal plant as this is the preferred source in South Africa. The development of a renewable energy source, as promoted by the South African Government would therefore not be realised, and reliance on fossil fuel energy sources and consequent reduction in CO_2 emissions would not be reduced.

In response to the above, the purpose of the proposed wind energy facility is to add new capacity for generation of renewable energy to the national electricity mix and to aid in achieving the goal of a 43% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE) in the IRP2010. The do-nothing alternative would result in this additional power from renewable energy not being added to the electricity grid. Although only a small contribution to the overall power requirements and renewable energy goals, the implementation of the proposed project (or any similar projects) is considered to provide possible environmental and socio-economic benefit at a local, regional and national level, and is in line with government policy. Therefore, the do-nothing alternative is not considered a preferred alternative as economic and environmental benefits associated with development of a renewable energy source outweigh the short-term and long-term impacts of project construction and operation.

Should the facility not be developed the benefits related to the generation of electricity from renewable energy resources will not be realised. 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 and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
- **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities 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.

2.5. Description of the Project Construction Phase

The construction phase of the wind energy facility is dependent on the number of turbines to be erected, but can be estimated at one week per turbine. It is therefore estimated that it will take approximately one year to construct the proposed facility. The construction of the proposed facility will mainly require the expertise of skilled staff, with limited opportunities for unskilled labour. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The following construction activities have been considered to form part of the project scope.

2.5.1. Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, survey of the substation site and survey of the power line servitude to determine tower locations. Much of this survey work occurs during the environmental feasibility process undertaken within the Environmental Impact Assessment (EIA) process. This is required in order to inform the preliminary layout of the facility which is assessed in the EIA.

2.5.2. Establishment of Access Roads to the Site

The northern section of the site is accessible from both the N2 National Road and R102 Regional Road. Access to the southern areas of the site is possible from the secondary road leading directly south from Humansdorp towards Oyster Bay, which then leads west towards the site. Access/haul roads to the site as well as internal access roads within the site are required to be established. As far as possible, existing access roads would be utilised, and upgraded where required. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines.

The main road access to the proposed is from the N2 (between Port Elizabeth and George) to the north of the site and Exit 632, which provides a link between the N2 and the settlements of Palmieitvlei and Oyster Bay to the south-east. This road is referred to as the Palmieitvlei Road (Green line in Figure 2.5) and is currently used by large dairy trucks to access the dairy farms in the area. An alternative access route is via the R102, which runs adjacent to the N1, and the secondary gravel road (Orange line in Figure 2.5) that runs to the west of the Impofu Dam in the direction of St. Francis Bay and Oyster Bay. A second alternative is via the R102 and the Witelsbos Plantation Road (Yellow line in

Figure 2.5) that crosses the N2 and links up with Portions 3 - 9 of Wittekleibosch 787.

These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary.

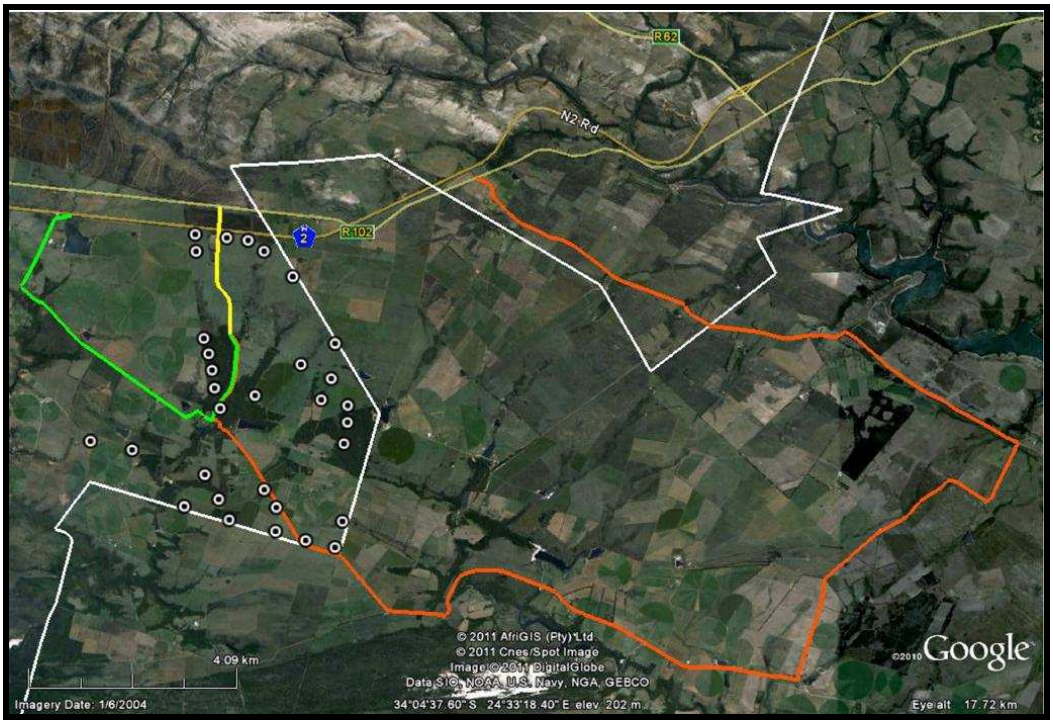

Figure 2.4: Location of access roads to the site

2.5.3. Undertake Site Preparation

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

2.5.4. Construct Foundation

Concrete foundations will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 2 m to 3 m (or more depending to the sandy nature of the soil. A geotechnical investigation will give an indication of the depth of the foundation hole). A batching plant will be required to be erected on site for construction of foundations. The dimensions of the reinforced concrete foundations are generally a maximum of 15 m x 15 m x

3 m. The foundation will be poured and will support a mounting ring. This will then be left for up to a week to cure.

2.5.5. Transport of Components and Equipment to Site

The wind turbine, including the tower, will be brought on site by the turbine supplier or a designated hauler in sections on flatbed trucks. Turbine units which must be transported to site consist of: the tower (in segments), nacelle and three rotor blades. The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989)[2] by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). In addition, components of various specialised construction and lifting equipment are required on site to erect the wind turbines and need to be transported to site. In addition to the specialised lifting equipment/cranes, the normal civil engineering construction equipment would need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.).

The components required for the establishment of the substation/s (including transformers) as well as the power lines (including towers and cabling) will also be transported to site as required.

The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (e.g. widening on corners), accommodation of street furniture (e.g. street lighting, traffic signals, telephone lines etc) and protection of road-related structures (i.e. bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading.

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

2.5.6. Establishment of Laydown Areas on Site

Laydown areas of ~25m x 50m will need to be established at each turbine position for the storage of wind turbine components. The laydown area will need to accommodate the cranes required in tower/turbine assembly. Laydown and storage areas will be established for the normal civil engineering construction equipment which will be required on site.

A laydown area, incorporated into the turbine component laydown area, will be required at each position where the main lifting crane will be required to erect the

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

turbine. This area would be required to be compacted and levelled to accommodate the above-mentioned necessary equipment.

Up to two larger main construction site laydown areas (each up to ~ 100m x 100m) will be required during construction for storage and maintenance of construction equipment.

2.5.7. Construct Turbine

A lifting crane will be brought on site. It will lift the tower sections into place. The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. It will then be lifted to the nacelle and bolted in place. A small crane will likely be needed for the assembly of the rotor while a large crane will be needed to put it in place. It will take approximately 2 days to erect a single turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.

2.5.8. Construct Substation

A 33/132kV substation will be constructed within the site footprint. The turbines will be connected to the substation via suitable switchgear, MV step-up transformers and trenched cabling. The local switchgear and transformers may be installed in the base of each tower. The dimensions of the substation area should not exceed 25m by 25m, and this will include a wind farm control room, site offices and limited parts storage.

Once micro-siting/positioning of the turbines has been finalised, the position of the main substation will be chosen to optimise cable lengths and associated losses. The construction of the substation would require a survey of the site; site clearing and levelling and construction of an access road to substation site (where required); construction of substation terrace and foundations; substation building, assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

2.5.9. Establishment of Ancillary Infrastructure

A workshop & administrative centre as well as a contractor's equipment camp may also be required to be constructed. The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A

laydown area for building materials and equipment associated with these buildings will also be required.

2.5.10. Connection of Wind Turbines to the Substation

Each wind turbine will be connected to an optimally positioned substation by underground electrical cables (33 kV). The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables will be planned to follow the internal access roads, where possible.

2.5.11. Connect Substation to Power Grid

One overhead power line (132 kV distribution line) will connect the substation to the electricity distribution network/grid from the proposed site to either the existing Diep Rivier substation or the existing Melkhout substation. A route for the power line will be assessed, surveyed and pegged prior to construction.

Three alignment alternatives are under consideration for this power line as discussed in section 2.3 above. Option A to Eskom's existing Diep Rivier substation ~ 8 km north of the proposed site; and Option B and Option C to Eskom's existing Melkhout substation ~ 25 km north east of the proposed site.

2.5.12. Undertake Site Rehabilitation

As construction is completed in an area, and as all construction equipment is removed from the site, the site rehabilitated where practical and reasonable will begin. On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

2.6. Project Operation Phase

The lifespan of the facility is approximated at 20 to 30 years. It is unknown at this stage how many employees would be required for the monitoring and maintenance of the facility, but in general, there should be three technicians for every 33 turbines installed.

Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities.

The operations staff would be responsible for routine maintenance, long-term maintenance, and emergency work on the turbines. Routine maintenance for the

turbines will include testing of lubricants for contaminants, changing of lubricants, calibrating and testing electronic systems, and tightening of bolts and components. Routine maintenance is generally completed on a scheduled basis by climbing the tower using the internal ladder and doing the work with normal hand tools and electrical testing equipment.

Long-term maintenance may include replacement/rebuilding and cleaning of larger components such as generators and gearboxes, testing of electrical components, and refurbishing blades.

Emergency work also may be required as the result of a system or component failure. Certain unplanned work such as blade repairs or repairs to other large components may require the use of a crane to complete the work.

2.7. Project Decommissioning Phase

The turbine infrastructure which will be utilised for the proposed Tsitsikamma Community Wind Energy Facility is expected to have a lifespan of approximately 20 - 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise the disassembly and then a subsequent upgrade and replacement of the turbines with more appropriate technology/infrastructure available at that time.

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

2.7.1. Site Preparation

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

2.7.2. Disassemble and Replace Existing Turbine

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable except for the blades.

However, as previously stated, it is most likely that decommissioning would involve the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1. Policy and Planning Context

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

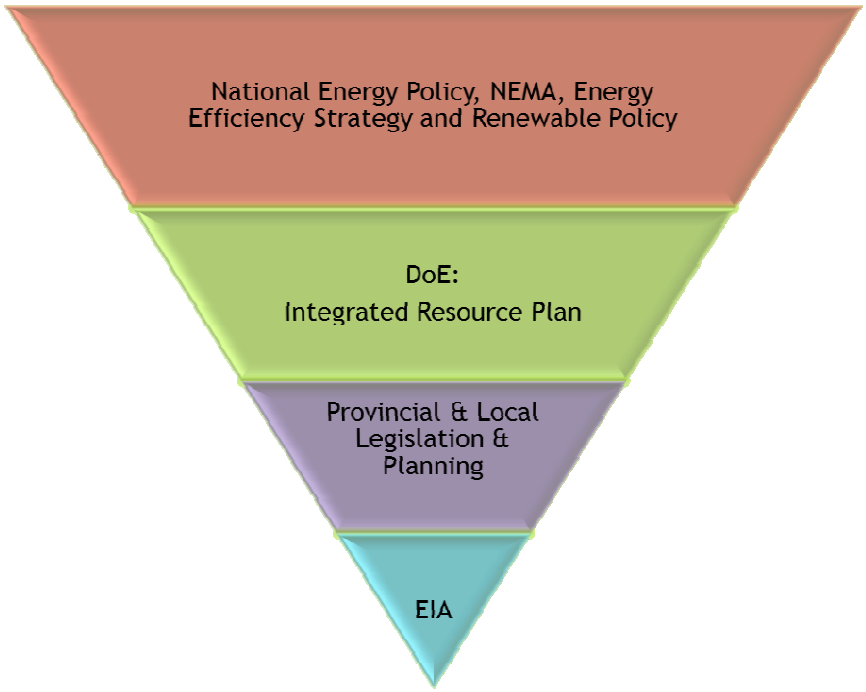

Figure 3.1: Hierarchy of electricity policy and planning documents

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

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

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the White Paper on Energy Policy for South Africa. In this

regard the document notes that government policy is based on an understanding that renewable energy sources have significant medium - long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

3.1.2. Renewable Energy Policy in South Africa, 1998

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing renewable energy in South Africa. The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. Government policy on renewable energy is therefore concerned with meeting economic, technical, and other constraints on the development of the renewable industry.

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

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

3.1.3. Final Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for

generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

» Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
» Ascertain South Africa's capacity investment needs for the medium term business planning environment;
» Consider environmental and other externality impacts and the effect of renewable energy technologies;
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies)

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

3.1.5 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers (IPPs). NERSA has recently published a request for qualification and proposals for new generation capacity under the IPP procurement programme, and is in the process of updating and developing its process in relation to the awarding of electricity generation licences.

3.2. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments (i.e. National, Provincial, and Local). The main regulatory agencies at a national level include:

» *Department of Energy (DoE)* - the DoE is the controlling authority in terms of the Electricity Act (Act No. 41 of 1987), and is responsible for policy relating to energy including renewable energy. Wind energy is considered under the White Paper for Renewable Energy and the DoE undertakes research in this regard.
» *National Energy Regulator of South Africa (NERSA)* - this body is responsible for regulating all aspects of the electricity sector, and will ultimately issue generation licenses for renewable energy developments.
» *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. DEA has been made the competent authority responsible for granting the relevant environmental authorisations for all renewable energy projects which are regarded of national importance.
» *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 Limited (SANRAL):* this department is responsible for all national road routes.

The main regulatory agencies at a provincial level include:

» *Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA)* - this department is responsible for environmental policy and is the provincial authority in terms of NEMA and the EIA Regulations. The DEDEA is the commenting authority for this project.
» *Eastern Cape Department of Transport and Public Works* - this department is responsible for provincial roads in the province and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Eastern Cape Department of Agriculture and Rural Development* - this department's involvement relates specifically to sustainable management of the agricultural resources in the Eastern Cape.

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

identification of priority areas for conservation and their placement within a planning framework of core, buffer, and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans. The main regulatory agencies at a local level include:

» *The Kouga Local Municipality* – this municipality is one of the principal regulatory authorities responsible for planning, land use, and environmental management.
» *The Cacadu District Municipality* – like the local municipality, this department is also a regulatory authority responsible for planning, land use, and environmental management.

3.3. Applicable Legislation and Guidelines

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

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R545, GNR 546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007)

Several other acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table that follows.

Table 3.1: Relevant legislative and permitting requirements applicable to the project

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project	National Department of Environmental Affairs – lead authority. Provincial Environmental Department - commenting authority.	This EIA report is to be submitted to the DEA and Provincial Environmental Department in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
National Environmental Management: Waste Act (Act No 59 of 2008)	» The purpose of this Act is to reform the law regulating waste management in order to protect health and the environment by providing for the licensing and control of waste management activities. » The Act provides listed activities requiring a waste license	Provincial Environmental Authorities.	Waste licence could be required in the event that more than 100m^3 of general waste or more than 35m^3 of hazardous waste is to be stored on site at any one time. The volumes of waste generated during construction and operation of the facility are not expected to be large enough to require a waste license.
Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Eastern Cape province have not yet	National Department of Environmental Affairs Provincial Environmental Department - commenting authority. Local authorities Local Municipality	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix F). There are noise level limits which must be adhered to.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns		
National Water Act (Act No 36 of 1998)	Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999.	Department of Water Affairs	Permits may be required for the crossing of drainage lines and water use for any on-site batching plant. Impacts on wetlands and drainage lines are considered in the ecology study (Appendix F) and soils study (Appendix I).
National Water Act (Act No 36 of 1998)	In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs (as regulator of NWA)	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in Section 39 of the Act.	Department of Mineral Resources	If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 34 makes provision for: (1) the Minister to prescribe essential national noise standards - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.	National Department of Environmental Affairs – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission licence issued in terms of section 22 may contain conditions in respect of noise. This will however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. Heritage Western Cape	Section 4 of the NHRA provides that within 14 days of receipt of notification the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe a

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		heritage resource may be affected. A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, gathering, uprooting, damaging or	National Department of Environmental Affairs	Compliance requirements

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	destroying). Schedule 3 lists endangered flora and Schedule 4 lists protected flora. An article 26 to 47 regulates the use of wild animals.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of Section 57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase. the developer has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the	National Department of Environmental Affairs	As the applicant will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies are required to be undertaken as part of the EIA process. These studies have been undertaken as part of the previously EIAs undertaken for the power station site. A specialist flora, fauna and wetland's assessment has been undertaken for the proposed project (refer to Appendix F). A permit may be required should any protected plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems.		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.		outside urban areas.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land. In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency.
National Forests Act (Act No 84 of 1998)	Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ` no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or	Department of Water Affairs	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	dispose of any protected tree, except under a licence granted by the Minister'. Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.		
Integrated Coastal Zone Management Act (Act No. 24 of 2008)	The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management	Department of Environmental Affairs: Marine and Coastal Management Directorate	Sections of the Act that may affect the current project area as follows: » A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis. » Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	of the coastal zone and contains a number of Chapters dealing with various components.		factors and criteria which the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant,	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the	Provincial Department of Transport (provincial roads) South African National Roads	An abnormal load/vehicle permit may be required to transport the various components to site for

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Agency Limited (national roads)	construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for	Provincial Environmental Department - commenting authority. Saldanha Local Municipality.	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	land development and conflict resolution.		development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land, or for the registration of a lease for longer than 10 years.	Consent of Minister of Agriculture to subdivide, or register long lease or servitude, in respect of agricultural land.	Subdivision will have to be in place prior to any subdivision approval in terms of in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project.
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act may find application during through the project EIA.
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested & affected parties have right to be heard	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act will find application during through the project EIA.
Provincial Legislation/ Policies / Plans			
Cape Land Use Planning Ordinance (No 15 of 1985)	Details land subdivision and rezoning requirements and procedures	Local authority, i.e. Kouga Local Municipality	Given that the wind energy development is proposed on land that is zoned for agricultural use, a rezoning application in terms of Section 17 of LUPO to an alternative

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			appropriate zone will be required. Rezoning is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.
Eastern Cape Provincial Growth and Development Programme	Section 5 of the PGDP (2004-2014) identifies six strategic objective areas of the PGDP. Of these the infrastructure programme is of relevance to the study. The report notes that development of infrastructure, especially in the former homelands, is a necessary condition to eradicate poverty.	Eastern Cape Department of Economic Development & Environmental Affairs (DEDEA)	Infrastructure development, in turn, must have strong growth promotion effects on the agriculture, manufacturing and tourism sectors by improving market access and by "crowding in" private investment. Poverty alleviation should also be promoted through labour-intensive and community based construction methods.
Cacadu District Municipality Integrated Development Plan	The strategic priories that are relevant to the project are as follows: » Identification of Economic Opportunities » Provision and Maintenance of Infrastructure » Enhancement of Skills and Education Systems » Sustainable Resource Management and Use	Cacadu District Municipality	The IDP development priorities highlighted in the Cacadu IDP are as follows: » Priority 1: Infrastructure Investment » Priority 2: Capacity Building and Support to Local Municipalities » Priority 3: Economic Development » Priority 4: Community Development

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Local Legislation / Policies / Plans			
Kouga Local Municipality Integrated Development Plan (2007-2012)	The Kouga Local Municipality Integrated Development Plan (IDP) (2007-2012) identifies 5 Key Priority Areas (KPA) in line with the National standards to address the municipality's development objectives: » Infrastructure and Basic Services; » Socio-economic Development; » Institutional Transformation; » Good Governance and Public Participation; » Financial viability and Management.	Kouga Local Municipality	The IDP objectives are relevant Those objectives that are relevant to the proposed project include: » Communities of Kouga have access to safe and convenient road networks. The road networks should support tourism, people's access to economic activities, as well as access to education, health and social service; » All formal households have access to reliable and affordable electricity as well as streetlights, which supports safety and access for emergency services in Kouga, by 2012; » Economic growth is stimulated in the Kouga region, and sustainable employment has been facilitated by creating a 5% growth in job creation by 2011; » Kouga Municipality manages the available land in a sustainable manner that makes land available for development initiatives and economic growth

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			that meets legal requirements.
Standards			
Noise Standards	Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are: » SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. » SANS 10210:2004. 'Calculating and predicting road traffic noise'. » SANS 10328:2008. 'Methods for environmental noise impact assessments'. » SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes.	Local Municipality	The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful per se.

3.3.1. Draft Future Regulations and Guidelines

» ***District Municipality Guidelines and Policies:***

The Cacadu District Municipality is currently in the process of working towards the development of a guiding document for the province, to be entitled '*Towards Positioning the Eastern Cape as the Epicentre of Renewable Energy in South Africa'.* This is being facilitated through Renewable Energy working group workshops which aims at encouraging dialogue between major role-players to ensure that the region takes full advantage of the opportunities in the renewable energy sector. At this stage, three focus areas have been identified:

1. Renewable Energy component manufacturing
2. Regulatory environment
3. Research, development and training

As part of the Regulatory environment, the municipality is intending to develop an efficient enabling system for renewable energy decisions. This will include a provincial strategic environmental assessment and municipal mechanisms to ensure appropriate zoning of renewable energy facilities and to provide infrastructural and other support.

As part of the initiative to plan for renewable energy, the Cacadu District Municipality is currently developing a *Land Use and Locational Policy for Renewable Energy Projects*. This policy is intended to be a tool and guideline to assist Local Authorities in decision-making as a point of departure for land use applications in the Cacadu District.

» ***Noise Control Regulations***

In terms of section 25 of the Environment Conservation Act (No 89 of 1989), the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Eastern Cape province have not yet adopted provincial regulations in this regard.

APPROACH TO UNDERTAKING THE EIA PROCESS CHAPTER 4

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

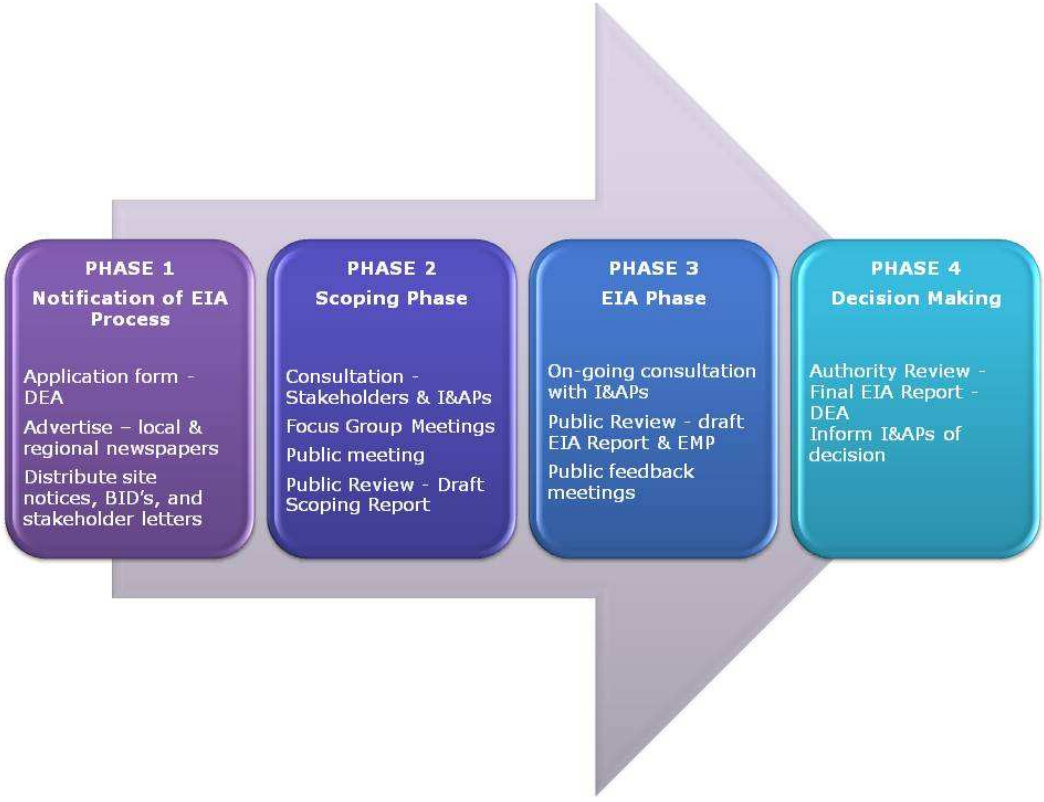

Figure 4.1: Phases included within an EIA process

The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA regulations.

4.1. Phase 1: Scoping Phase

The Scoping study, which commenced in February 2011, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping report aimed at detailing the nature and extent of the proposed facility, identifying potential issues associated with the project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation

process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the "do nothing" option) were identified for consideration within the EIA process.

The draft Scoping report was made available at public places for I&AP review and comment. All the comments, concerns, and suggestions received during the Scoping phase and the review period were included in the final Scoping report and plan of study for EIA. The final Scoping report was submitted to the National Department of Environmental Affairs (DEA) and was accepted in August 2011 (refer to authority correspondence included in Appendix B). In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

4.2. Phase 2: EIA Phase

Through the Scoping Phase, although no environmental fatal flaws or absolute 'no-go' areas were identified, a number of **potentially sensitive areas** were identified. These included areas of agricultural land within centre pivot irrigation systems; high sensitivity ecological areas; potentially sensitive noise receptors within the study area and potential heritage sites within the area. A number of issues and potentially sensitive areas requiring further study for both the wind energy facility development site as well as the associated infrastructure were highlighted. These issues have been assessed in detail within the EIA Phase of the process (refer to Chapter 6).

The EIA phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed wind 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&AP are afforded the opportunity to participate in the EIA process, and that their issues and concerns are recorded.

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

The EIA process followed for this project is described below.

4.3. Overview of the EIA Phase

The EIA phase has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public involvement process throughout the Scoping Phase in accordance with Chapter 6 of Government Notice No R543 of 2010 in order to identify issues and concerns associated with the proposed project.
» Preparation of a Comments and Response report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of Government Notice No R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of Government Notice No R543 of 2010.

These tasks are discussed in detail below.

4.3.1. Authority consultation

Consultation with the regulating authorities (i.e. DEA & DEDEA) and Organs of State which have jurisdiction in respect of the activity to which the application relates has continued throughout the EIA process. On-going consultation includes the following:

» Submission of a Final Scoping report (May 2011) following a 30-day public review period (and consideration of stakeholder comments received).
» Future provision (i.e. following the submission of the Final EIA Report), of an opportunity for DEA and DEDEA representatives to visit and inspect the proposed site, power line options, and the study area.

The following was undertaken as part of this EIA process:

» Consultation with Organs of State that may have jurisdiction over the project:
  * National, provincial, and local government departments (including DEA, DEDEA, South African Heritage Resources Association, Civil Aviation Authority, Department of Agriculture, Department of Water Affairs, South African National Roads Agency Limited, etc.)
  * Government Structures (including the provincial roads authority, municipal planning departments, etc.)
  * Kouga Local Municipality
  * Cacadu District Municipality

4.3.2 Public involvement and consultation: EIA Phase

The public involvement process was initiated at the start of the EIA process and has continued throughout the Scoping and EIA Phases. The aim of the public participation process was primarily to ensure that:

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

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

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

» **Focus group meetings** (pre-arranged and stakeholders invited to attend)
» One-on-one **consultation meetings** and telephonic consultation sessions (consultation with various parties, for example with directly affected landowners and local municipalities, by the project participation consultant as well as specialist consultants)
» Written, faxed or e-mail **correspondence**.
» **Stakeholder** and **community meetings** (to be held during the review period of the Draft EIA Report)

4.3.3. Identification and recording of issues and comments

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

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

4.3.4 Assessment of issues identified through the scoping process

Based on the findings of the Scoping study, the following issues required further investigation within the EIA phase (refer to Table 4.1).

Table 4.1: Specialist studies undertaken within the EIA phase

Specialist	Area of Expertise	Refer to Appendix
David Hoare Consulting	Ecological impact assessment	Appendix F
Avisense Consulting	Avifauna impact assessment	Appendix G
Outeniqua Geotechnical Services	Geology, soils & erosion potential study	Appendix H
Terrasoil	Agricultural Potential	Appendix I
Eastern Cape Heritage Consultants	Heritage impact assessment &	Appendix J
Natura Viva	Paleontological assessment	Appendix K
MetroGIS	Visual impact assessment	Appendix L
MENCO	Noise impact assessment	Appendix M
Tony Barbour Environmental Consulting and Research	Social impact assessment	Appendix N

Specialist studies considered direct and indirect environmental impacts associated with the development of the proposed facility and all associated infrastructure, as well as the options for the alignments/corridors of the proposed power line. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected, and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * Medium-term (5–15 years) – assigned a score of 3;
  * Long term (> 15 years) - assigned a score of 4; or

- Permanent - assigned a score of 5.

» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
- 0 is small and will have no effect on the environment;
- 2 is minor and will not result in an impact on processes;
- 4 is low and will cause a slight impact on processes;
- 6 is moderate and will result in processes continuing but in a modified way;
- 8 is high (processes are altered to the extent that they temporarily cease); and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
- Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
- Assigned a score of 2 is improbable (some possibility, but low likelihood);
- Assigned a score of 3 is probable (distinct possibility);
- Assigned a score of 4 is highly probable (most likely); and
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» The **status**, which is described as 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:** Moderate (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As Exxaro Resources and Watt Energy have the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft Environmental Management Plan (EMP) is included as Appendix O. The specialist EIA studies are contained within Appendices F - M.

4.3.5 Public review of draft EIA report and feedback meetings

The Draft EIA Report was made available for public review from **16 September 2011 to 17 October 2011** at the following locations:

» Kareedouw Library
» Clarkson Library
» www.savannahsa.com

All registered I&APs were notified of the availability of the report and the public meeting by letter. In addition, newspapers advertisements were placed in *The Herald* and the *Die Burger* newspapers on 13 September and 8 September 2011 respectively.

In order to facilitate comments on the Draft EIA Report and provide feedback of the findings of the studies undertaken, public/community meetings were held during the review period. This is the **current phase** of the EIA process.

4.3.6 Final EIA Report

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

4.4 Assumptions, Limitations and Gaps in Knowledge

Wind energy facilities are a new development type in South Africa and, to date, have not been implemented on a large scale. Therefore certain gaps in knowledge, assumptions, and uncertainties which are likely to occur during the EIA process are discussed below.

In conducting this EIA process, the following general assumptions have been made:

» The motivation as to the selection of the proposed development site (including details pertaining to the wind resource etc.) provided by Exxaro Resources and Watt Energy is sufficient and defendable.
» Only one site is available for the establishment of the proposed facility and will be considered in the EIA, and no other sites are available to be included as alternative sites in the EIA. This is based on the detailed wind analysis (with specific

measurements on site) which has been done to date as well as on land availability, access to the site, grid connectivity, etc.

» It is assumed that the development site identified by Exxaro Resources and Watt Energy represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure.

» The EIA study was conducted based on a preliminary layout of the wind energy facility provided by Exxaro Resources and Watt Energy. It is understood that this layout is preliminary at this stage of the project development cycle, and it is assumed that this layout is approximately 80% accurate, and subject to some change.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 5

This section of the Draft EIA Report provides a description of the environment that may be affected by the proposed Tsitsikamma Community Wind Energy Facility in the Tsitsikamma area of the Eastern Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly 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 reports contained within Appendices F - N.

5.1. Regional Setting

The study area is incised by a large number of perennial rivers. These include the Klasies and Tsitsikamma Rivers to the west of the site and the Klipdrift, the Krom, the Seekooi, the Swart and the Kabeljous to the east. The Gamtoos River is located in the far north west of the study area. In addition to the above rivers, a number of dams and water bodies occur, especially in the coastal plain area, and on the site itself (refer to Figure 4.1). With its temperate coastal climate, the study area receives between 379 mm to 574 mm of rainfall per year in the south, and between 574 mm and 725 mm per year in the north.

The towns of Humansdorp, Kruisfontein, Jeffrey's Bay and Sea Vista account for the highest population concentration within the region, which has an average of 15 people per km^2.

The Köppen-Geiger Climate Map indicates that this area falls within the marine temperate climatic region of South Africa which is characterised by frontal weather, leading to changeable, often overcast and moderate conditions. Seasonal variation in temperatures is generally mild, but snow can occur at high altitudes on the mountain ranges to the north of the study area. Midday temperatures typically range between 15 and 25°C and mean annual precipitation between 600-850 mm. The climate is semi-humid and chemical weathering processes are likely to be dominant in the region.

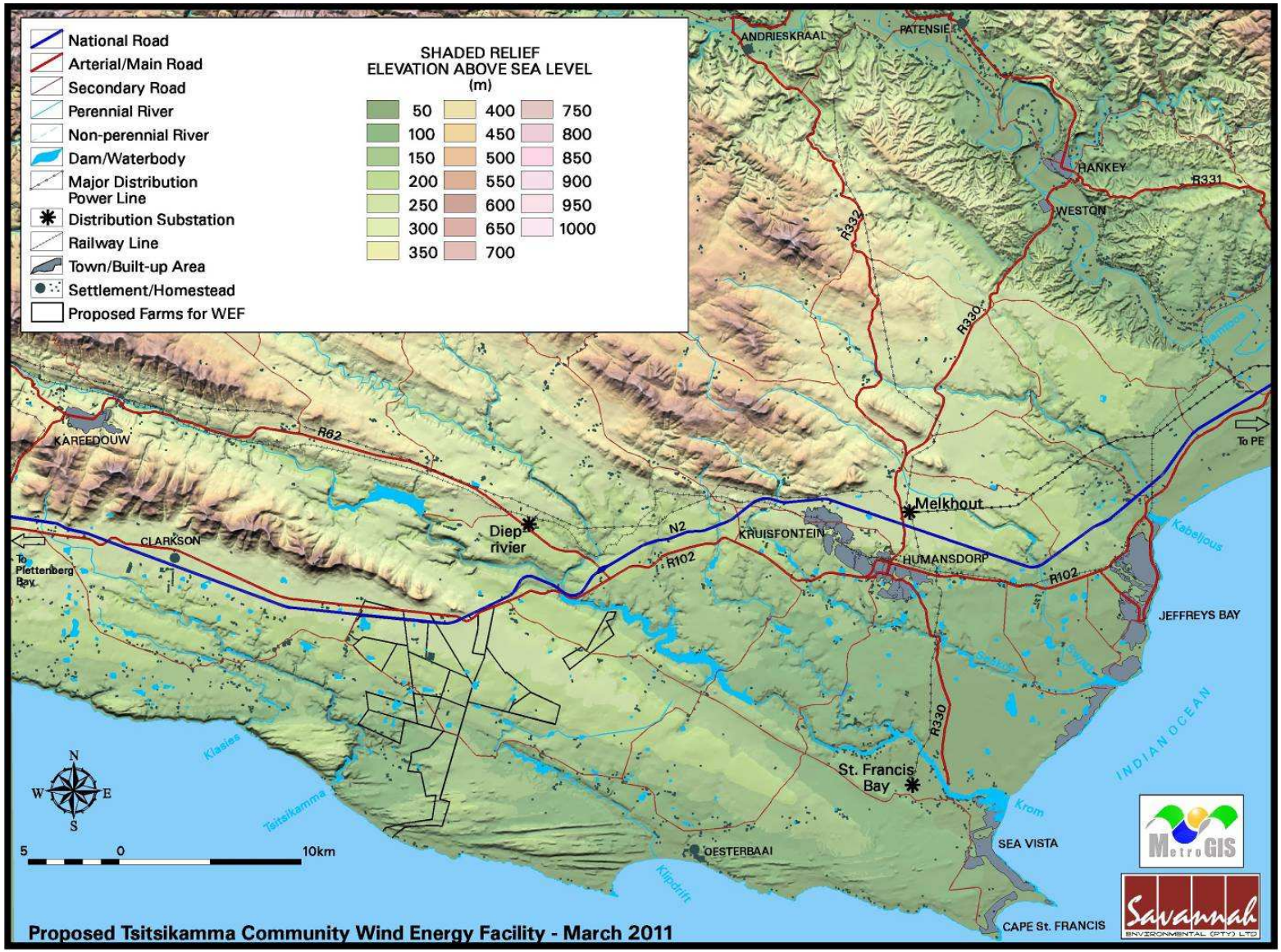

Figure 5.1: Shaded relief map (indicating the location of the proposed wind energy facility and the topography and elevation above sea level) of the broader study area.

5.2. Location of the Study Area

The proposed development site is located within Kouga Local Municipality of the Eastern Cape Province. The site is located approximately 10km northwest of Oyster Bay, 20 km west of Humansdorp and approximately 30 km east of Kareedouw. The Kouga Local Municipality is one of 10 municipalities that fall within the greater Cacadu District Municipality (DC10).

The location of the proposed area for the development of the wind energy facility comprises of the following farm portions:

- Portions 19 and 22 of Zalverige Valley 660;
- Portions 3 and 5 of Vergaaderingskraal 675;
- Portion 1 of Ou Driefontein 721;
- Portion 2 of New Driefontein 720;
- Portions 3 - 9 of Wittekleibosch 787;
- Farm 818;
- Remainder of Farm 678; and
- Portion 3 of Kliprug 676.

These farm portions extend from the N2 to the Indian Ocean coast line south of the site.

The main economic activity of the area is described as mixed agriculture/farming land uses that include irrigated agriculture and cattle farming. Land cover (as defined by the available Surveyor General data) is dominated by planted grassland, pastures and agricultural fields in the central study area and on the site itself. To the immediate north-west, there is Exotic Plantation. In the north of the study area, land cover is mostly shrubland interspersed with thicket and bushland as well as agricultural fields. Large tracts of agricultural fields also occur along the Gamtoos River. In the south, along the coast, significant areas of thicket and bushland occur, with pockets of shrubland and bare rock / natural soil (Figure 4.2).

The land use of the proposed site and the surrounding area outside of the urban node of Humansdorp is largely rural and agricultural. The main forms of agriculture in the Kouga Local Municipality are game farming, deciduous fruit and dairy farming (Kouga Local Municipality IDP, 2007-2012).

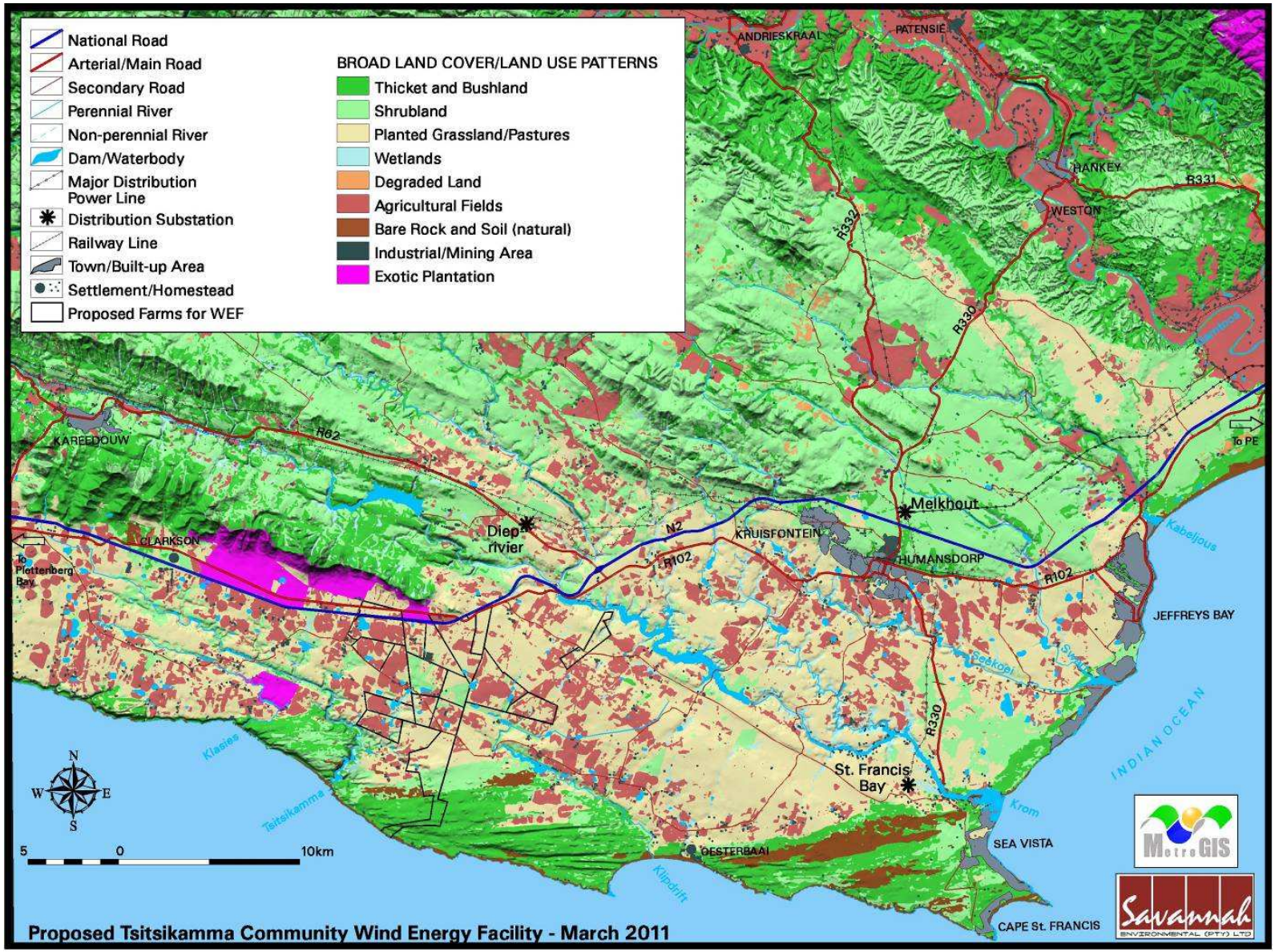

Figure 5.2: Land cover/land use map of the study area

5.2. Conservation Areas in the Region

The region has a rural character, and lies within a particularly picturesque part of South Africa, in close proximity to the southern seaboard of the country. It is a known tourist destination. The Eastern Cape has nine tourism routes of which the Kouga Route, encompassing Jeffrey's Bay, Cape St Francis and the Gamtoos River Valley, is of relevance in the study area.

Large areas within the region have been given over to conservation, or remain in a natural state. Conservation areas in the region include the following (Refer to Figure 5.3):

» Game Farms:
- Jumanji Game Farm (7km to the north east);
- Thaba Manzi Game Farm (7km to the north east); and
- Lombardini Game Farm (20 km to the east).

» National Heritage Sites:
- Kromrivierspoort National Heritage Site (3km to the north);
- Klasies River Cave National Heritage Site (5km to the south west);
- Thyspunt National Heritage Site (15km to the south east); and
- Kabeljous River National Heritage Site (more than 20km to the north east).

» Provincial Nature Reserves:
- Kabeljous River Provincial Nature Reserve (more than 20km to the north east); and
- Eastern Cape Guerna Wilderness Area Provincial Nature Reserve (more than 20km to the northwest).

» Other Reserves:
- Huisklip Nature Reserve (2km to the south west);
- Kareedouw Nature Reserve (17km to the north west);
- Rebelsrus Private Nature Reserve (17km to the south east);
- A number of small conservation areas are also dotted along the coastline; and
- State Forest (to the immediate north-west of the site, as well as in small patches along the coastline).

The Garden Route National Park lies well to the east of the proposed site, outside of the study area.

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

1. PA: Protected areas.
2. CBA 1: CR vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. CBA 2: EN vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
4. CBA 3: VU vegetation types.

Within and around the study area, the ECBCP identifies CBAs at three levels that occur within the study area and surroundings (Figure 5.4). The CBA 1 areas that fall within the study site are vegetation types of high conservation value, in this case Eastern Coastal Shale Band Vegetation, Garden Route Shale Fynbos and Humansdorp Shale Renosterveld, all classified as Endangered. The CBA 2 areas that fall within the study site are corridor areas and vegetation identified in the STEP project as being important (Southern Cape Dune Fynbos). The corridor areas are important for a number of reasons, including the maintenance of ecological processes. The CBA 3 areas that fall within the study site are vegetation types of conservation importance (in this case Tsitsikamma Sandstone Fynbos). Despite the site falling into these CBAs the vegetation is largely transformed due to cultivation, except for the southern third of the site.

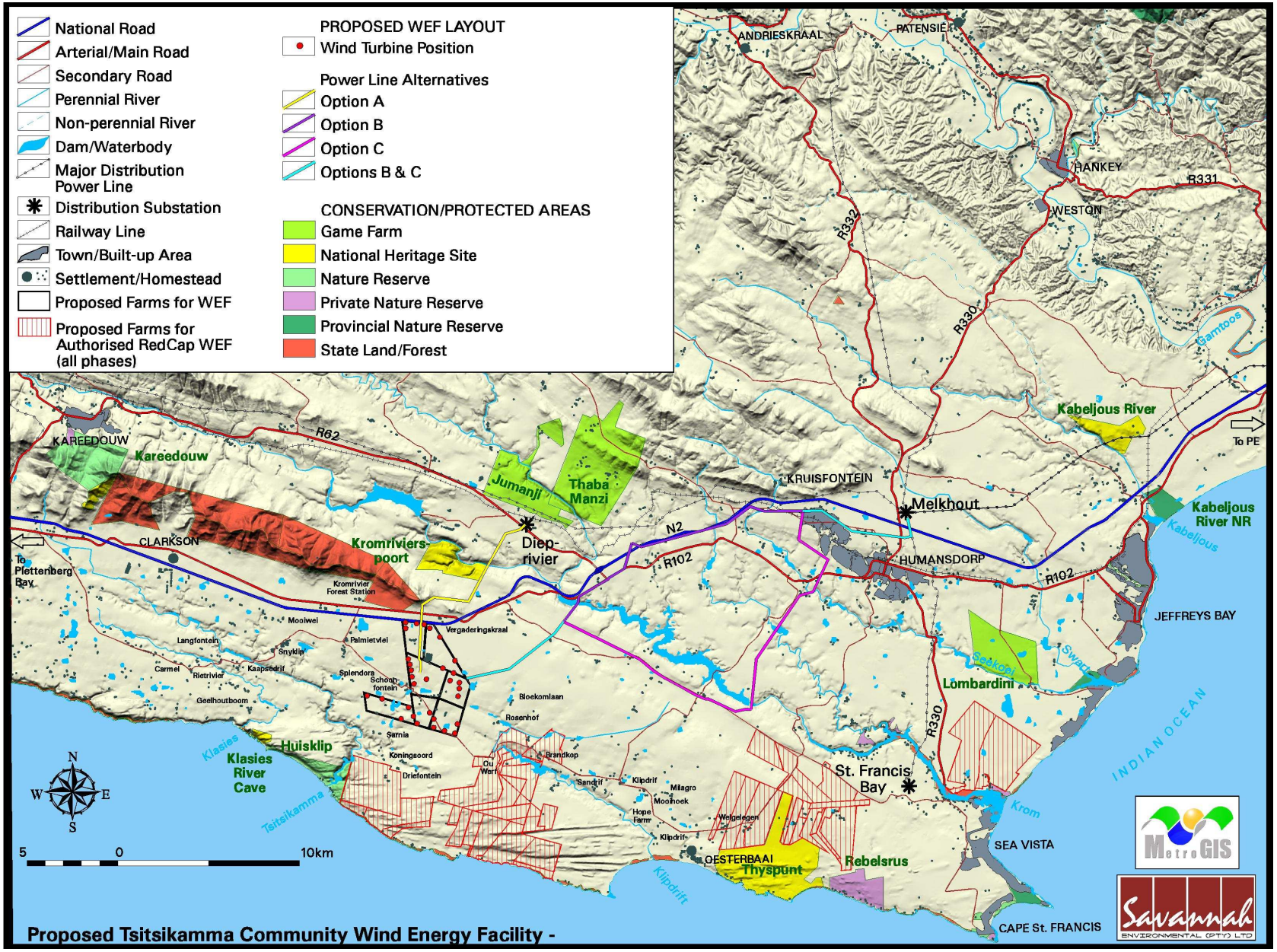

Figure 5.3: Formal Conservation areas in the region

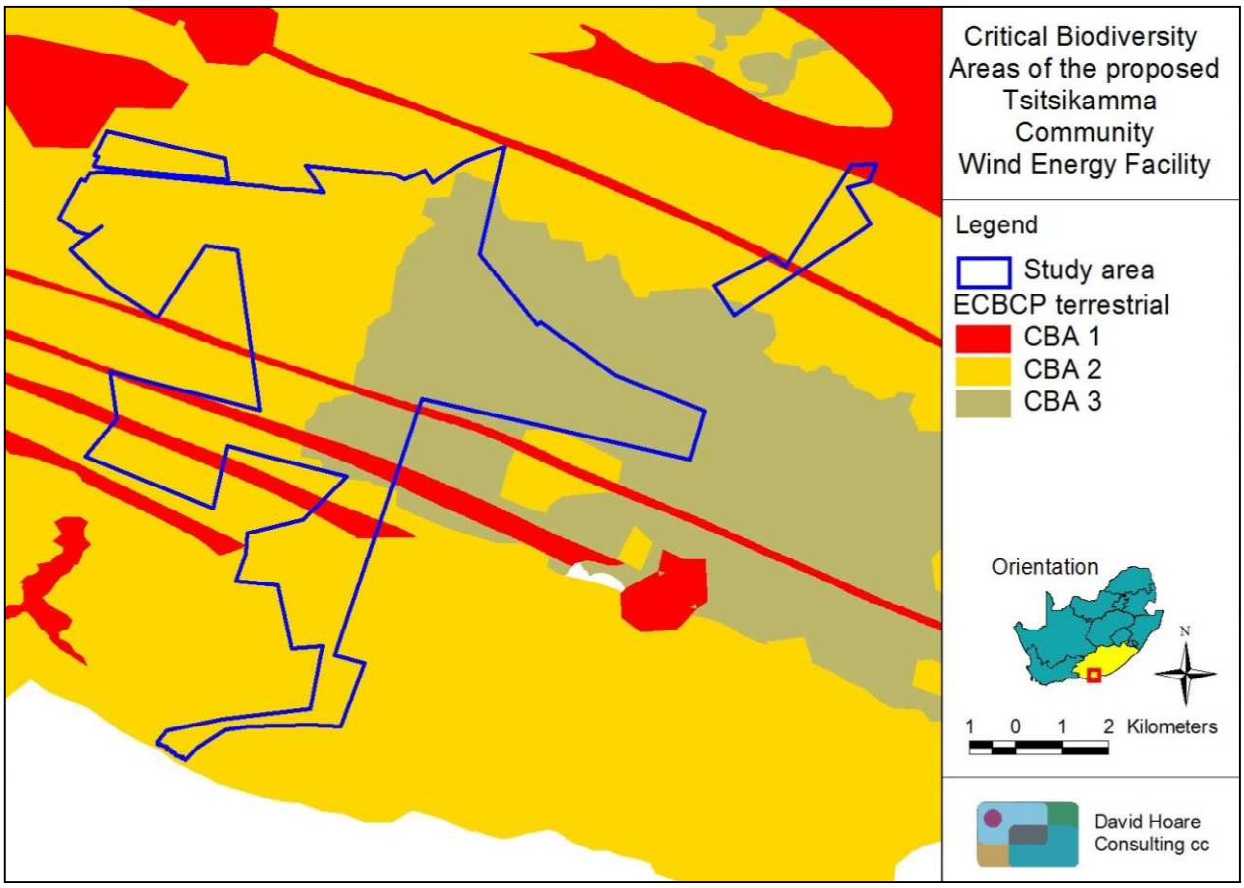

Figure 5.4 Important biodiversity areas of the study area

5.3. Geology and Hydrology

The northern portion of the study area is underlain by rocks of the Palaeozoic Cape Supergroup (blue, purple and green in Figure 5.5 which are unconformably overlain in the southern portion of the study area by Plio-Pleistocene (Tertiary-Quaternary) and Holocene (Quaternary) deposits of aeolian sands of the Nanaga Formation and Schelm Hoek Formations, respectively (indicated as red and yellow in Figure 5.5 below)

The geological sequence of the older Table Mountain Group of the Cape Supergroup that is exposed in the study area consists of the basal Peninsula Formation quartzites, successively overlain by Cederberg Formation shales, Goudini Formation sandstone, Skurweberg Formation quartzites, and Baviaanskloof Formation sandstones. In localised areas, Gydo Formation shales (Bokkeveld Group of the Cape Supergroup) are exposed along the axis of synclines, resting on an unconformity between exposures of older Baviaanskloof Formation.

The Cape rocks are folded along northwest-southeast trending axes. This folding is a result of compressional deformation during the Permo-Triassic collision of the

Pan-African and African plates. Subsequent tensional forces during the Jurassic-Cretaceous breakup of Gondwana produced significant normal faulting in the Cape Supergroup, producing several large half-grabens into which Cretaceous sediments were deposited to the east and west of the study area. There are no significant geological faults in the immediate vicinity of the study area and the region is considered to be seismically stable.

Hard quartzite rock outcrops and gravelly talus soils are likely to occur in areas underlain by Peninsula and Skurweberg Formations. Slightly softer sandstone with clayey, sandy and gravelly soil overburden are expected in areas underlain by Goudini and Baviaanskloof Formations. Relatively soft shale and clayey, gravelly residual soil is expected in areas underlain by Cederberg and Gydo Formations. The Tertiary-Quaternary aeolian deposits (red and yellow in Figure 5.5), which occur in the southern portion of the study area, consist of unconsolidated to semi-consolidated sands of several meters thick.

The study area drains into the catchment areas of the Klipdrif and Tsitsikamma Rivers to the east and west of the study area, respectively. Surface infiltration is likely to be low due to the presence of near-surface rock or low permeability soils and therefore a significant percentage of rainfall will end up as surface run-off. The presence of well-defined drainage lines are an indication of significant surface drainage. The percentage run-off has implications for water erosion potential.

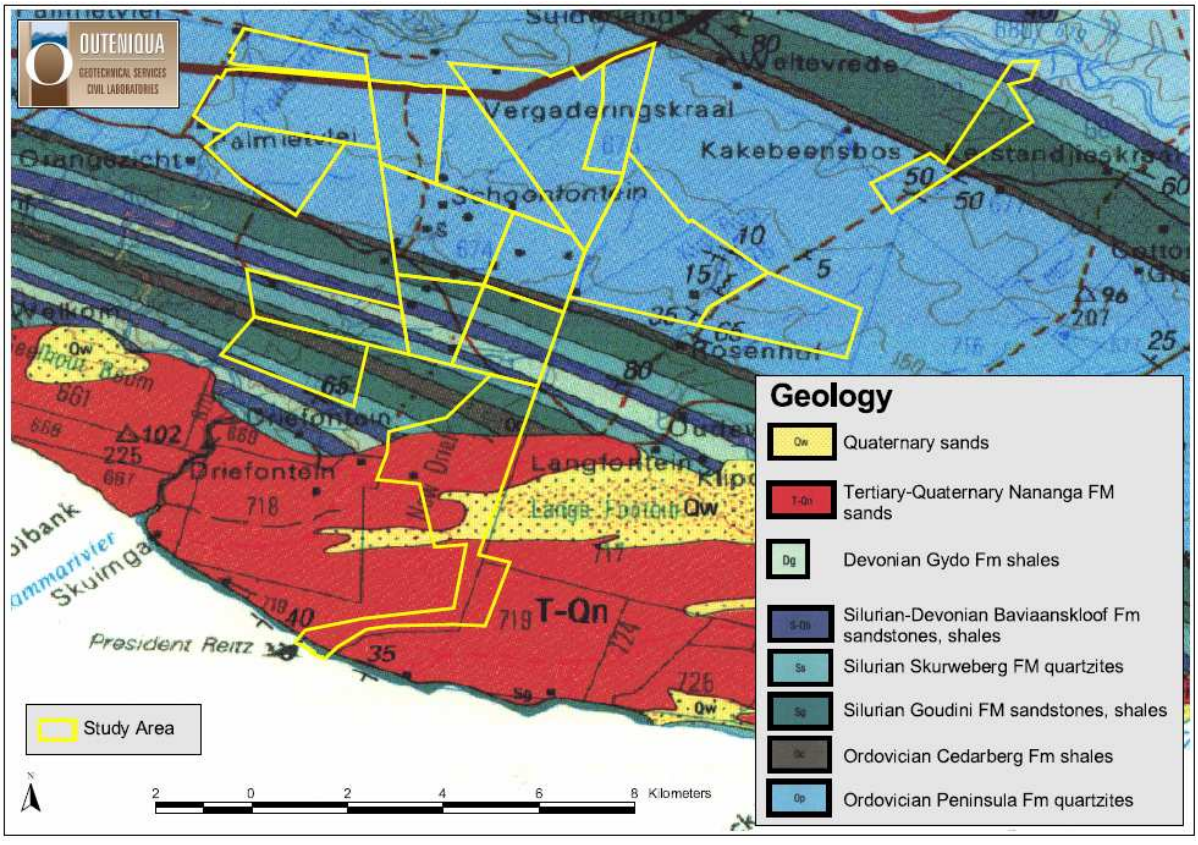

Figure 5.5 Geology of the study area

5.4. Agricultural Potential

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). A site visit was conducted in August 2011, during which a reconnaissance soil survey was conducted. The soil data was interpreted and re-classified according to the Taxonomic System (MacVicar, C.N. et al. 1991).

The areas under investigation are shown to be covered by the following land types (Figure 5.6), namely:

» Bb75 (Yellow-brown, structureless, highly weathered plinthic soils)
» Ca78, Ca79, Ca80, Ca81 (Red and yellow, structureless plinthic soils, also with clayey duplex soils)
» Ha47, Ha49, Ha50 (Deep, grey sandy soils)

The aerial photograph interpretation of the site yielded a number of land uses and potential wetland areas. The land uses include extensive grazing on untransformed land, grazing of improved pastures, irrigation of improved pastures and wattle plantations (Figure 5.7). The wetlands occur throughout the site within the grazing areas and sometimes on the edge of or within irrigated fields. The land uses as identified during the previous phase were confirmed during the site visit and survey. The reconnaissance soil survey confirmed the land type data.

Although the site has a large degree of variation in soil form the soils tend to act similarly in terms of their land use and agricultural characteristics (within limits). The essence is that the soils have a very low nutrient storage and holding capacity as well as low water holding capacity in the sandy layers.

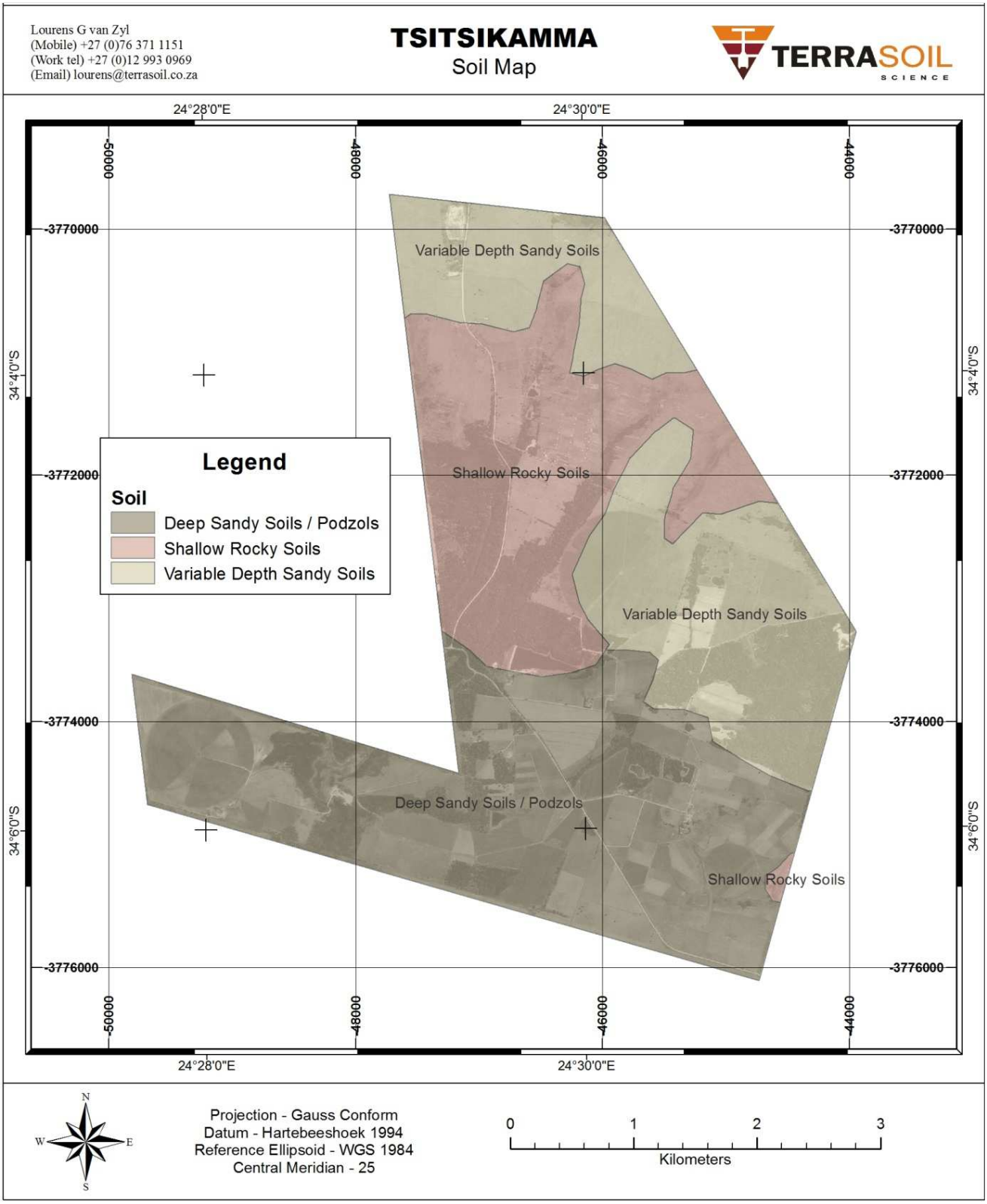

Figure 5.6: Generalised soil map of the survey site

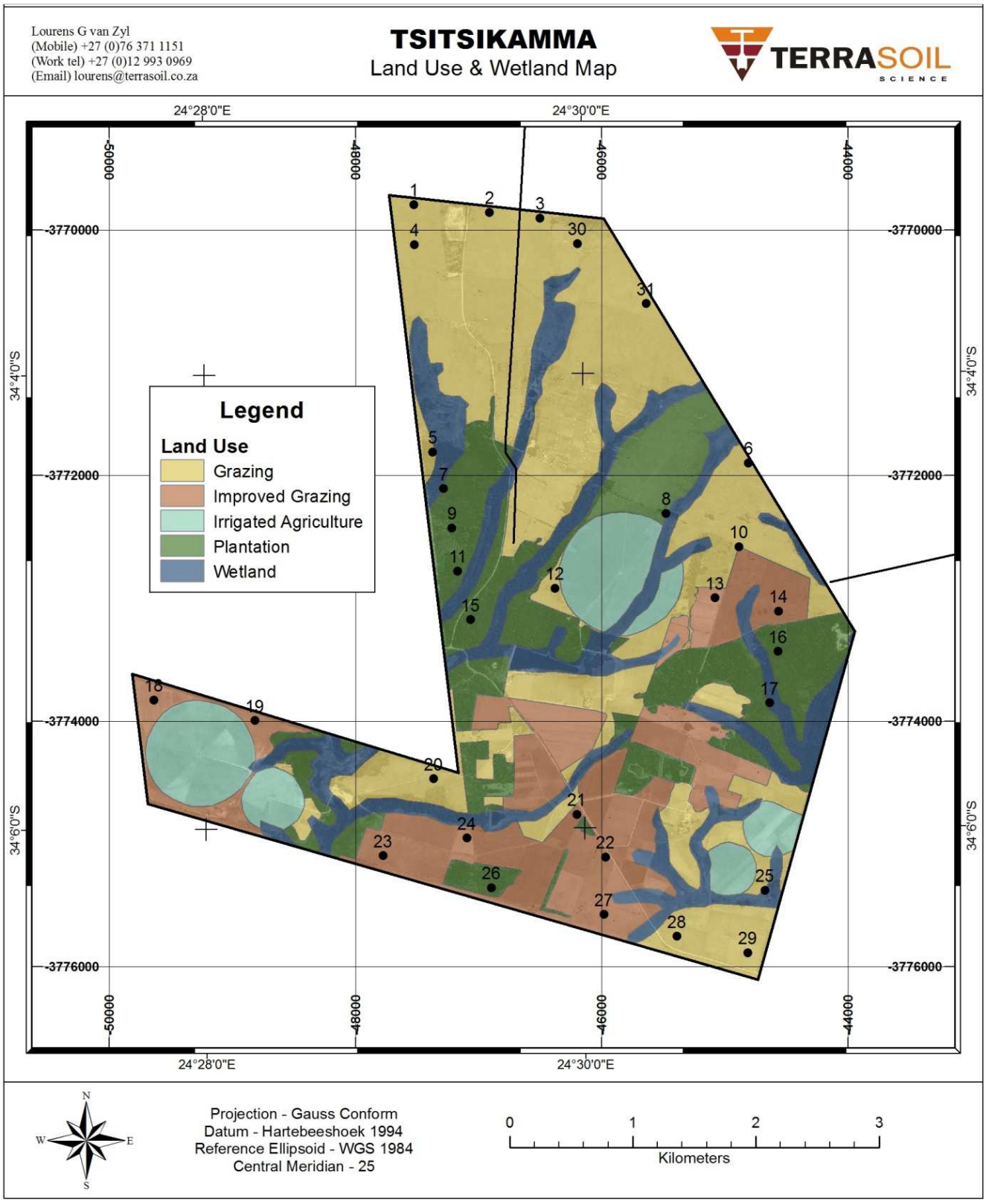

Figure 5.7: Land uses in the study area indicating proposed turbine positions (black numbered dots)

The agricultural potential of the site is directly linked to the soils. The shallow and rocky soils are predominantly of low potential and the deeper sandy soils are of medium potential. The potential of the sandy soils is limited due to their sandy nature leading to low nutrient and water holding capacity. This is especially relevant in an area with variable rainfall. In the cases where irrigation infrastructure has been established the potential of the soils increases to high. The high potential comes at a price in the form of distinct risks of nutrient leaching leading to losses in agriculture and to eutrophication of water sources. The agricultural use is limited to grazing with improved pastures under irrigation as well as plantations.

5.5. Ecological Profile of the Study Area

5.5.1. Vegetation

According to the most recent vegetation map of the country (Mucina *et al.*, 2005), the study area falls primarily within two main vegetation types, i.e**.** ***Tsitsikamma Sandstone Fynbos*** and ***Southern Cape Dune Fynbos***, both of which fall within the Fynbos Biome. There are also small areas of five other vegetation types apparently occurring on site and along the proposed power line route options, namely ***Eastern Coastal Shale Band Vegetation***, ***Garden Route Shale Fynbos***, ***Humansdorp Shale Renosterveld***, ***Algoa Dune Strandveld*** and ***Cape Seashore Vegetation***. There are areas of Southern Afrotemperate Forest indicated as occurring nearby, but none of this appears to occur on the site (Figure 5.8).

Tsitsikamma Sandstone Fynbos is found along the Tsitsikamma Mountains from Uniondale to Cape St Francis. This landscape consists of relatively low mountains with gentle to steep slopes. The vegetation type occurs on both the northern and southern slopes of the mountains. It is a medium-dense, tall proteoid shrubland over a dense, moderately tall ericoid-leaved shrubland (Rebelo et al. 2006). This vegetation type occurs in the northern half of the site under assessment (Figure 5.8), most of which is transformed by cultivation on site.

Southern Cape Dune Fynbos occurs in the Western and Eastern Cape from Wilderness and Buffels Bay near Knysna to Oyster Bay. The vegetation type occurs on the coastal dune cordons, often with steep slopes. It is a fynbos heath vegetation dominated by sclerophyllous shrubs with a rich restio undergrowth (Rebelo et al. 2006). This vegetation type occurs in the southern half of the site under assessment (Figure 5.8), which appears from aerial imagery to be largely intact on site.

Eastern Coastal Shale Band Vegetation occurs on the shale bands in the eastern Outeniqua, Langkloof, Tsitsikamma and Kareedouw Mountains and along

the southern Cape coastal plains to around Oyster Bay. These shale bands form narrow strips 80 - 200 m wide that are smooth and relatively flat. The vegetation type ranges from thicket to renosterveld and fynbos, including all structural types, although they are often grassy in character (Rebelo et al. 2006). This vegetation type occurs in three narrow bands through the study area (Figure 5.8), all of which appear to have been transformed by cultivation.

Garden Route Shale Fynbos occurs primarily from Heidelberg to Plettenberg Bay, but also in patches along coastal platform shale bands south of the Tsitsikamma Mountains. The vegetation occurs on undulating hills and moderately undulating plains on coastal forelands. It is a tall, dense proteoid and ericaceous fynbos in wetter areas and graminoid fynbos in drier areas. Most shale areas are covered by afrotemperate forest so this fynbos is confined to flatter more extensive landscapes that are exposed to frequent fire. In the study area, this vegetation type is confined to a single narrow band that lies in an east-west direction through the centre of the site (Figure 5.8), which appears from aerial imagery to be completely transformed on site.

Humansdorp Shale Renosterveld occurs, across its geographic range, in three swathes, one of which extends from Jeffreys Bay near the coast inland past Humansdorp to the lower reaches of the Dieprivier near Two Streams. The vegetation type occurs on moderately undulating plains and undulating hills. It is a vegetation composed of low, medium dense graminoid, dense cuppressoid-leaved shrubland, dominated by renosterbos (Rebelo et al. 2006). There are both grassland shrubland and grassland forms of the renosterveld. Thicket patches are common on termitaria and fire-safe enclaves. This vegetation type occurs as a small sliver in the extreme northern part of the site (Figure 5.8), which appears from aerial imagery to be intact.

Algoa Dune Strandveld occurs in the Eastern Cape Province in a narrow coastal strip from the mouth of the Tsitsikamma River to the Sundays River mouth (Mucina *et al.*, 2006). It is found on dunes mainly outside the influence of salt spray. It is a dense thicket dominated by stunted trees, shrubs (often armed with spines and thorns), abundant lianas and sparse herbaceous and grassy undergrowth. It occurs on site in a short section along the coast, just inland of the shoreline (Figure 5.8).

Cape Seashore Vegetation occurs along the Eastern and Western Cape Province coasts from the Olifants River mouth on the Atlantic Ocean to East London on the Indian Ocean (Mucina et al., 2006). It is found on beaches, coastal dunes, dune slacks and coastal cliffs. It may be open, grassy, herbaceous and sometimes dwarf-shrubby, sometimes succulent vegetation, often dominated by single pioneer species. The plant communities present reflect the age of the substrate and natural disturbance regime, distance from the upper tidal mark and

the exposure to prevailing winds. This vegetation occurs along the short section of shoreline on site (Figure 5.8), which consists of a mixture of rocky areas and dune sand.

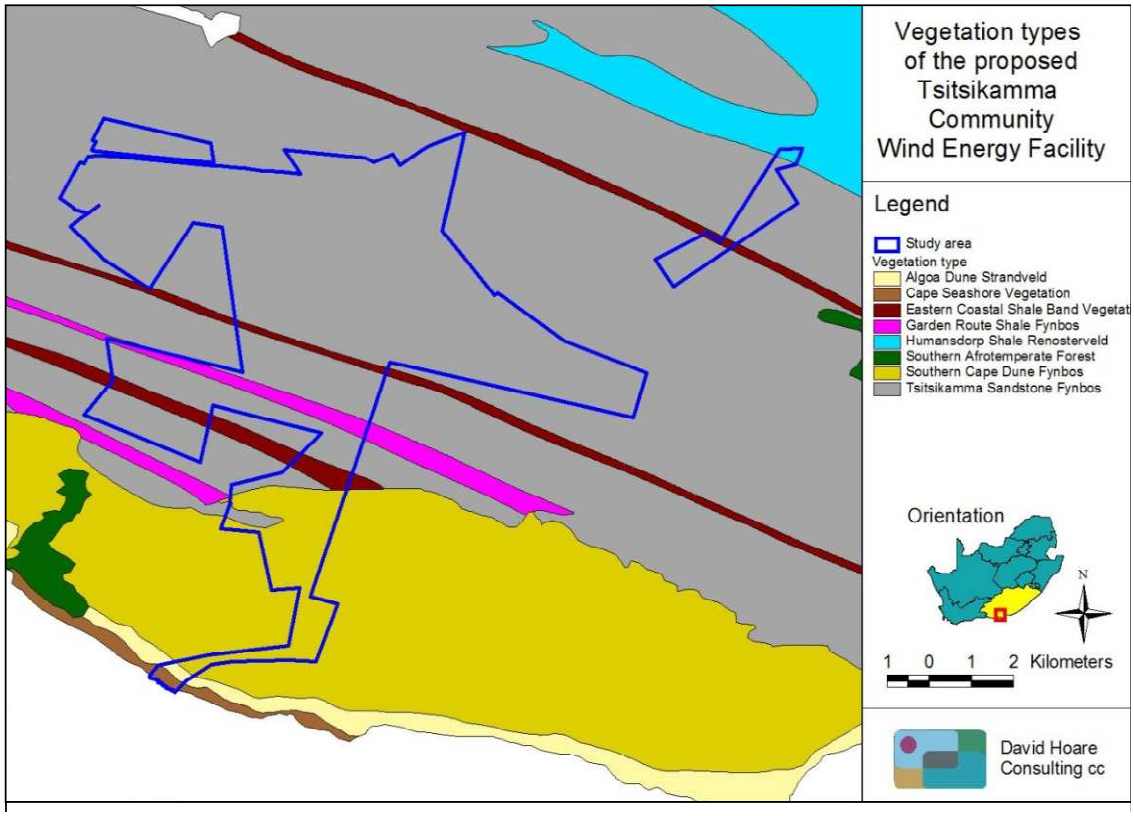

Figure 5.8: Vegetation map of the study area.

The study area also occurs within the Cape Floristic Region, which is recognised as one of the principal centres of diversity and endemism in Africa.

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 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.

The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were fifteen species recorded in the quarter degree grid in which the study area is located that are listed on the Red List that could occur in habitats that are available in the study area. According to IUCN Ver. 3.1 one of these is listed as Critically Endangered, two as Endangered,

eight as Vulnerable and four as Near Threatened[3]. All except three of these species are highly likely to occur on site; the site is at the locality where the species have been previously recorded or the species have been recorded just adjacent to the site in similar habitats.

Tree species protected under the National Forest Act are listed in Appendix 3 of the Ecology Study (Appendix F). Based on habitat preferences, any of these species could occur on or near the site. If any of these species occur in the study area, the most likely places would be in the thicket in the drainage lines or in woodland patches.

5.5.2 Terrestrial Fauna

All Red List vertebrates (mammals, reptiles, amphibians, fish) that could occur in the study area are listed in Appendix 2 of the Ecology Study (Appendix F).

There are a number of mammal species of conservation concern that have a distribution that coincides with the study area. Only four of these are considered to have a possibility of occurring on site as a result of habitats available, i.e. the Brown Hyaena, the Fynbos Molden mole and the Natal Long-fingered Bat, all listed as Near Threatened.

There are two reptile species and no amphibian species of conservation concern that have a distribution that includes the study area and which could occur on site. The two reptile species are the Spotted Rock Snake (Rare) and the Yellow-bellied House Snake (Near Threatened). Therefore, there are no threatened reptile or amphibian species that are likely to occur on site.

5.5.3 Avifauna

The study area is located about 30 km south-east of the Kouga-Baviaanskloof Complex, 25 km east of the Tsitsikamma National Park, and about 50 km west of the Maitland-Gamtoos Coast – all of which are recognised as national Important Bird Areas, and are likely to support a diverse avifauna, including some significant populations of rare, threatened and/or endemic species. The area is likely to support over 240 bird species, including 19 red-listed species, 41 endemics, and four red-listed endemics. Resident and/or seasonal influxes of large terrestrial birds, in particular Denham's Bustard and Blue Crane, and a range of locally resident or visiting raptors, which may forage in or move through the area, including Martial Eagle, African Marsh Harrier, Black Harrier, Peregrine Falcon and Lanner Falcon, are the species of greatest conservation significance which are most likely to be impacted by the wind energy facility.

[3] Refer to Table 3 in the Ecology Assessment (Appendix F) for an explanation of these categories.

Table 1 in the Avifauna Study (Appendix G) lists Red-listed bird species considered likely to occur within the impact zone of the proposed wind energy facility, with estimates of their relative susceptibility to the environmental impacts of the construction and operational phases of the development.

Avian microhabitats comprise small, isolated areas of rocky Fynbos or Renosterveld covered hills (mostly in the south of the broader development area), in a dominant matrix of cultivated fields and pastures. The deep valleys of the Klipdrift (east) and Tsitsikamma Rivers (west) and their immediate tributaries contain substantial patches of riparian thicket or forest (generally heavily infested by alien trees), and there are smaller patches of similar habitat along some of the smaller watercourses and drainage lines. The area also features a mosaic of small artificial dams and wetlands.

5.6. Heritage and Palaeontology Profile

Most of the proposed area for the construction of the Tsitsikamma Community Wind Energy Facility is further than 5km from the coast and falls outside the maximum distance coastal archaeological features such as shell middens are expected to be located from the beach. Apart from a few Earlier and Middle Stone Age stone tools, no other archaeological sites/materials were observed and in general the area appears to be of low archaeological sensitivity.

Some 6km south-west from the Tsitsikamma Community Wind Energy Facility is the Klasies River complex of caves and several open air shell middens. This is one of the most significant archaeological cave complexes in the world, and home to the oldest anatomically modern human skeletal remains (Homo sapiens sapiens) (Singer & Wymer 1982; Rightmire & Deacon 1991; Deacon 1992, 1993, 1995, 2001; Deacon, H. J & Shuurman, R. 1992; Deacon & Deacon 1999). The archaeological deposits at the Klasies River Caves date to 120 000 years old (Deacon & Geleijnse 1988).

The immediate coastal zone between Klasies River and Klippepunt has not yet been systematically researched orsurveyed in any detail. However, several visits over the years demonstrated that this stretch of coast is similar to the Thysbaai coast and exceptionally rich in shell middens and other features. Large complexes of shell middens were observed especially at the Tsitsikamma River mouth and Klippepunt area.

The proposed Tsitsikamma Community Wind Energy Facility is located in an area of the southern Cape coastal plain that is underlain by a number of geological formations of Palaeozoic to Late Caenozoic age, three of which are known to

contain important fossil heritage resources, viz. the Cedarberg, Baviaanskloof and Gydo Formations.

Most of these rocks have a poor fossil record but there are three marine units that are potentially highly fossiliferous (as outlined in Section 3 of the Paleontological Study Appendix K). These three sensitive units crop out in the central and north-eastern sectors of the study area. The Cape Supergroup rocks in the study area lie within the south-eastern sector of the Cape Fold Belt of Permo-Triassic age. Levels of tectonic deformation here are high as a result of intense crustal compression, with steep bedding plane dips. A major anticlinal axis runs along the line of the Kareedouwberge, with a broad zone of Peninsula Formation quartzites at its core. Several smaller-scale anticlinal and synclinal folds extend to the northeast and southwest of this major structure, largely constructed of Nardouw Subgroup and lower Bokkeveld Group rocks. Narrow outcrops of Gydo Formation are mapped along the cores of the tight synclines. It is likely that the mudrock-dominated successions of the Cedarberg and Gydo Formations here are highly cleaved, and perhaps locally faulted- or squeezed-out, but levels of metamorphism within the Cape Fold Belt are generally low.

5.7 Social Characteristics of the Study Area and Surrounds

The population the Kouga Municipality is estimated at 73 274 (Community Survey, 2007) with an annual growth rate of ~2.4% per annum (Kouga Local Municipality IDP, 2007-2012). The population constitutes approximately 18% of the greater Cacadu District. The population density within the Municipality is estimated at 30.3 people/km (Community Survey, 2007). The majority of the population (~75%) lives in the urban nodes while ~25% live in rural villages or homesteads (Kouga Local Municipality IDP, 2007-2012).

The age profile of the population reveals that approximately 66% of the population falls within the economically active age bracket 15 to 65 years of age. The dependency ratio is, however, is 0.5 which means that every 2 working individual supports 1 non-working/unemployed individual.

Just under half of the population is classified as Coloured (47.7%) followed by Black African (33.4%) and White (18.7). These demographics are reflected in the dominant languages within the Municipality, with 64.9% of the population being Afrikaans speaking, 29% isiXhosa speaking and 4.9% English speaking.

The level of education within the Municipality is relatively high. Just over 10% of the population (~ 1 in 10) has no schooling, while over 20% have Std 10/Grade 12 certificate. Approximately 6% of those with a Grade 12 qualification go on to obtain an education at University/Technikon level.

Unemployment within the Municipality is estimated at 15.4% (2001) which in below the Eastern Cape average of ~32% (Eastern Cape State of the Environment Report, 2004), while ~42% of the population are listed as 'not economically active'. The largest sectors in terms of employment within the municipality in 2001 were Agriculture, Forestry & Fishing (~9%), Community Service (~8%%), Wholesale and Retail (4%) Construction (~3%) and Manufacturing (~2%). The 2001 Census data listed 73% as Undetermined.

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

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

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

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

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

6.1. Assessment of Potential Impacts – overarching methodology

In order to assess the impacts associated with the proposed wind energy facility, it is necessary to understand the extent of the affected area. The affected area

primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A study area of approximately 54 km^2 is being considered as a larger study area for the construction of the proposed wind energy facility. From the results of the facility layout determination exercise, it is now apparent that the effective utilised area required to accommodate the infrastructure is in fact approximately 178700 m^2 in extent. This area to be occupied by turbines and associated infrastructure, and is illustrated in Figure 6.1 below, and would include:

» **Wind Turbines** (with a hub height of up to 100 m) with a total generating capacity of ~100 MW
» **Foundations** (of up to 15 x 15 x 3 m) to support the turbine towers
» Underground cables between turbines
» A **substation** (25 x 25m) within the development site
» An overhead **power line** (i.e. 132 kV distribution line) which will link to the existing Eskom Melkhout Substation ~ 25 km northeast of the proposed site
» Internal **access roads** (of up to 6m wide) to each wind turbine.
» **Main access road / haul road** to the site
» Workshop / administration building

A new overhead power line will be constructed to connect the on-site substation to the electricity distribution grid via Eskom's existing Diep Rivier Substation which lies approx 10 km north of the proposed site, or Alternatively to Eskom's existing Melkhout Substation, which lies approx 25 km north east of the proposed site. Routes for the power line will be assessed, surveyed and pegged prior to construction. Three alternative corridors are proposed for the proposed power line (refer to Figure 6.1):

» **Option A** exits the site on its northern boundary and runs north, crossing over the N2 and the R102. Thereafter it turns to the east to connect with the national grid at the Diep Rivier Distribution Substation. The length of this option is 11,91km.

» **Option B** exits the site on its north eastern boundary and runs to the north east until it reaches the N2. It follows the alignment of the N2 for some distance, turning to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 29,76km.

» **Option C** exits the site on its north eastern boundary and runs to the north east for about 5km before turning to the south east. Some 10km further on, the alignment bends back to the north east before it turns sharply to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north

to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 38,59km.

The sensitivity of the proposed routes for the power lines and proposed substation position(s) have been assessed through this EIA report.

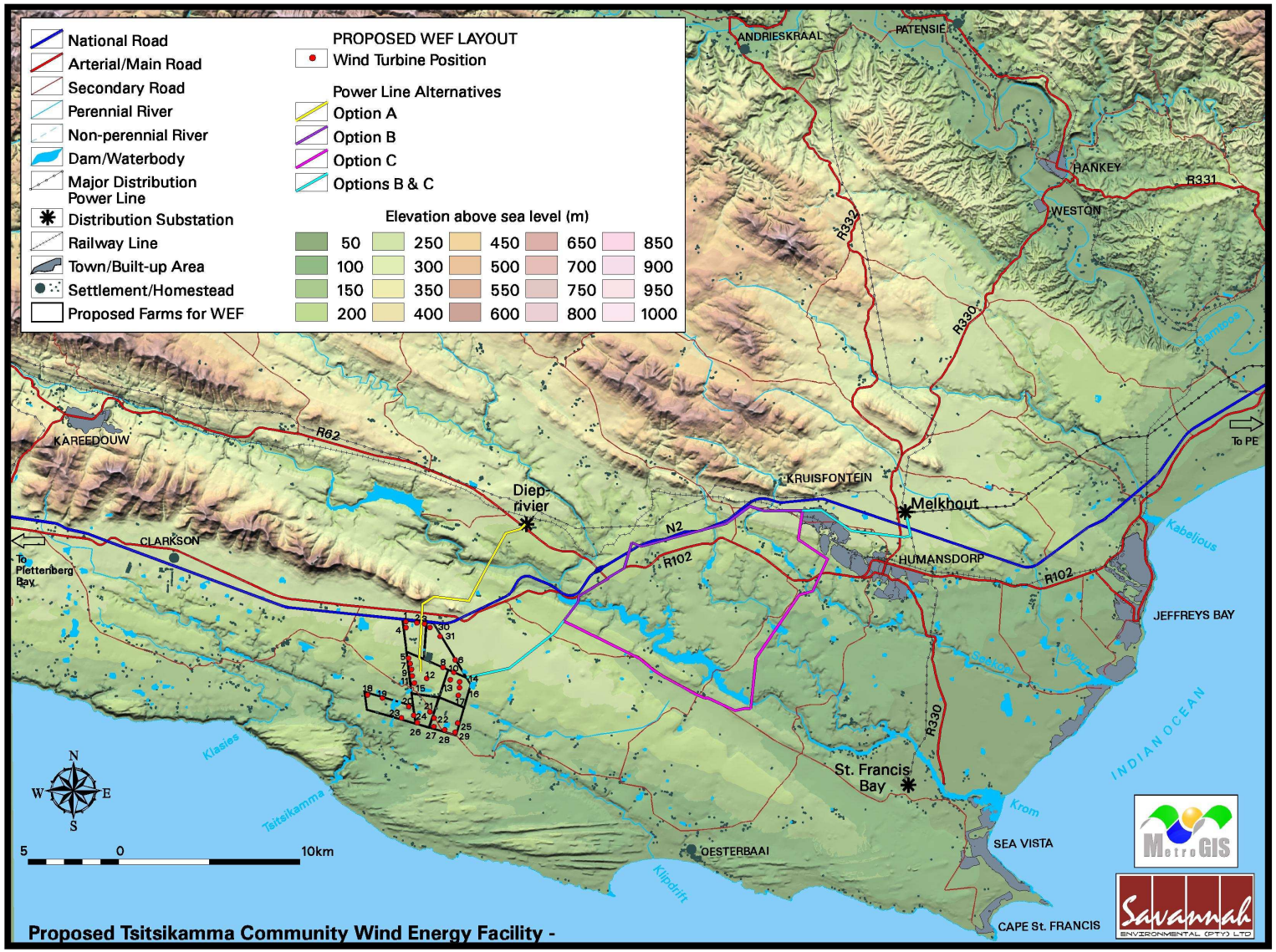

Figure 6.1: Locality map showing provisional wind turbine layout, substation site and power line corridors

6.2. Assessment of Potential Impacts on Ecology

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

There are six vegetation type that occurs on site and along the power line routes, namely Tsitsikamma Sandstone Fynbos (classified as Vulnerable), Southern Cape Dune Fynbos (classified as Least Threatened), Eastern Coastal Shale Band Vegetation (classified as Endangered), Garden Route Shale Fynbos (classified as Endangered), Humansdorp Shale Renosterveld (classified as Endangered), Algoa Dune Strandveld (classified as Least Threatened, but protected under national legislation) and Cape Seashore Vegetation (classified as Least Threatened, but protected under national legislation). The vegetation on site has been classified at a Provincial level, through the Eastern Cape Biodiversity Conservation Plan (ECBCP), as having elevated conservation value. Some parts of the site are considered to have higher conservation value than others. The area is also within the Cape Floristic Region, one of the earth's 25 hotspots. It must be noted that these are broad-level assessments and do not take site-specific conditions into account, for example, the location of remaining areas of natural vegetation. It does, however, provide context in terms of the regional value of such remaining patches.

Factors that may lead to parts of the study area having high ecological sensitivity are the presence of wetlands, drainage lines, potential presence of erodable substrates, the potential presence of various plant and animal species of conservation concern, and protected trees.

Drainage lines, watercourses and wetlands represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches (Rosenberg et al., 1997).

The drainage lines on site drain into two main systems that lead to the sea via the Klipdrif and Tsitsikamma Rivers. The site constitutes part of the catchment for these rivers. The mouths of the rivers have an estuary, which is considered to be very sensitive and is shown as having high conservation value and sensitivity in the ECBCP. The potential impacts of activities on site on these river systems need to be carefully managed. It is especially important that the estuaries are not affected by activities on site, for example, increased water turbidity due to erosion of substrates into upper reaches of watercourses.

There are eight tree species that are protected under the National Forests Act that have a geographic distribution that includes this area. One species (i.e. white milkwood) occurs in large numbers within the vegetated dune cordon in the southern portion of the site as well as in scattered individuals in drainage lines and on small rocky outcrops within fynbos areas. Any impacts on individuals of any of these species require a permit from the relevant National Department.

Parts of the site are still in natural condition or considered to be natural vegetation; while a large proportion of the site is transformed by agriculture and dense invasion by alien trees. All transformed and/or degraded areas have been classified as having low ecological sensitivity, whereas natural areas have high or very high sensitivity. The area with very high ecological sensitivity is the vegetated dune cordon in the southern parts of the site, whereas drainage lines and remaining patches of fynbos are classified here as having high sensitivity.

There are fifteen plant species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Critically Endangered, two species classified as Endangered, eight as Vulnerable and four as Near Threatened. The area of dunes in the southern part of the site appears to be key habitat for many of these species, although there are some species that may occur in other localities on site.

There are four animal species of conservation concern that may occur in habitats within the study area that may be affected by the proposed facility. All four are classified as Near Threatened.

Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity.

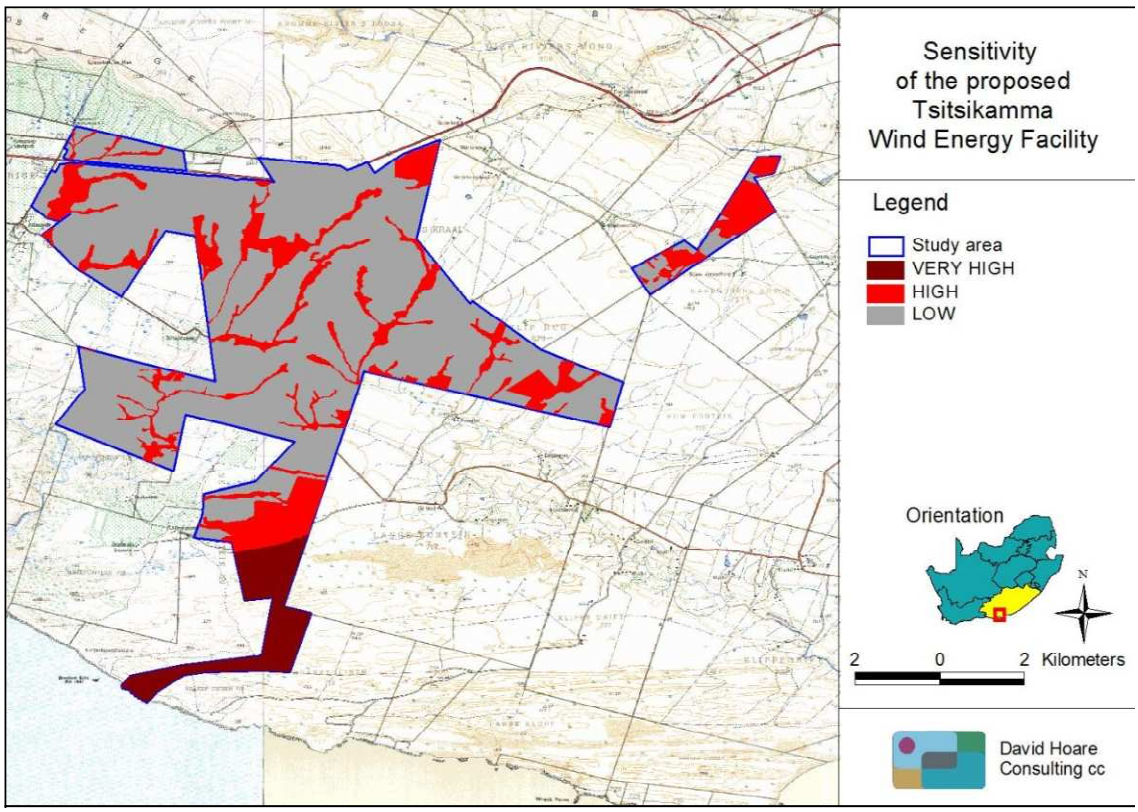

Figure 6.2: Map indicating the sensitive ecological areas in the study area

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

» The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (sensu Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it can be seen which areas are transformed versus those that are still in a natural status.
» Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment, Eastern Cape Biodiversity Conservation Plan (ECBCP). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
» Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive

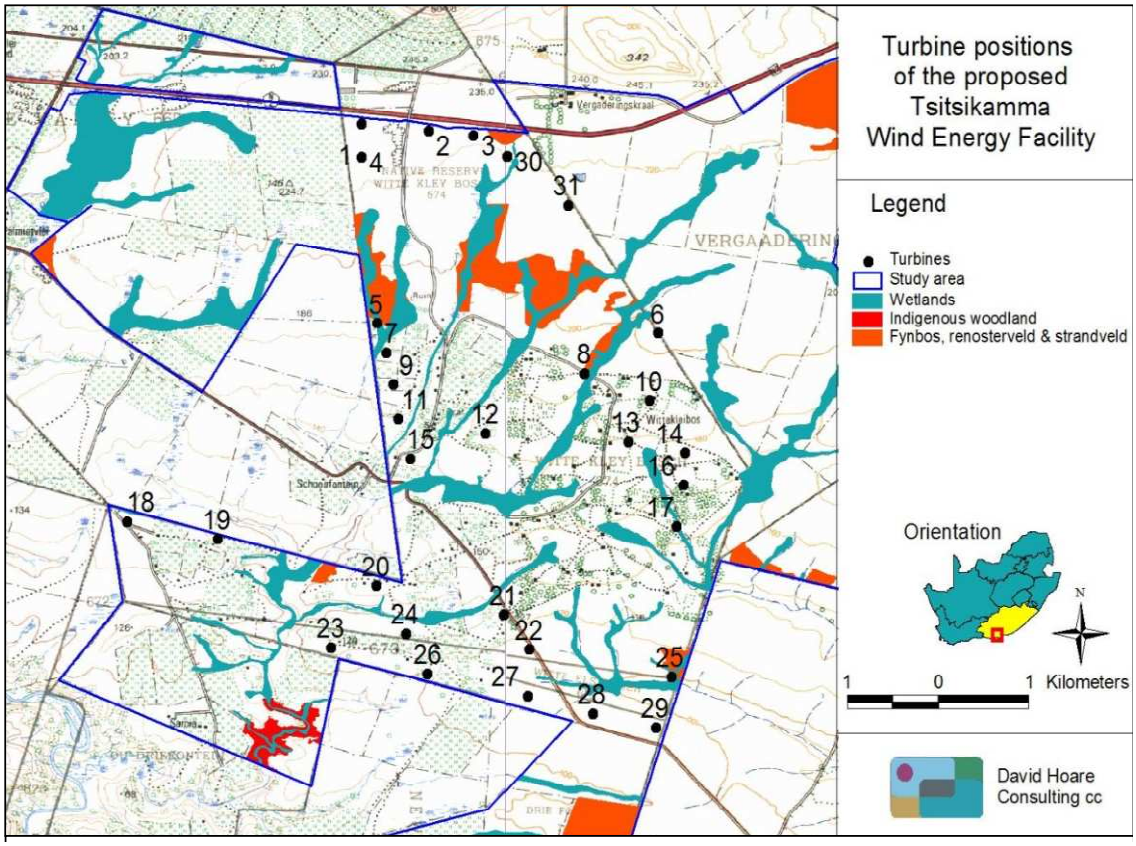

Figure 6.3: Turbine positions in relation to sensitive features on site.

The major potential impacts are described briefly below.

» **Impacts on bats**

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has been evaluated that there is one Near Threatened bat species that could occur site or in the surrounding areas, the Natal Long-fingered Bat. This species is most likely to be affected by the operation of the facility to a greater extent than the construction of the facility.

» **Impacts on threatened animals**

Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction. It has been evaluated that there are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility:

1) The Brown Hyaena is a mobile animal that is likely to avoid the site during construction and re-appear afterwards. This species is therefore unlikely to be affected by construction of the proposed infrastructure. This species is therefore unlikely to be affected by construction or operation of the proposed infrastructure and impacts on this species are not assessed further.

2) The Yellow-bellied House Snake is usually found in rocky areas. On-site, these are the areas that have not been ploughed, i.e. the remaining patches of natural fynbos. Although listed as Near Threatened, occurs throughout a wide part of South Africa and is very unlikely to be significantly affected by the complete loss of the site, which constitutes a very small fraction of its potential overall range. This species is therefore unlikely to be affected by construction of the proposed infrastructure and impacts on this species are not assessed further.

3) The Fynbos Golden Mole is found in lowland fynbos and Knysna forest, also in urban areas. It prefers sandy soils with a deep litter layer. The dune area in the southern part of the site is the most suitable habitat on site for this species. The mole species is not mobile and, if it occurs on site, is likely to be affected by the construction of infrastructure since it is largely unable to move away during construction and is dependent on habitat remaining intact.

» **Impacts on threatened plants**

Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat. There are twelve Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes two species classified as Endangered, seven as Vulnerable and three as Near Threatened. There is also one Critically Endangered species, one Vulnerable species and two Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would probably occur within the dune habitat in the southern part of the site.

» **Impacts on protected tree species**

There are a number of tree species that are protected according to NG1012 under section 12(I)(d) of the National Forests Act (Act No. 84 of 1998). In terms of section1 5(1) of the National Forests Act, 1998 "no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an applicant and subject to such period and conditions as may be stipulated". No turbines are proposed for the area within which a lrage number of protected tree species occur, and it is therefore considered highly unlikely that any protected trees will be affected by installation of turbines. The significance of this impact is rated as zero for this infrastructure component and not assessed further.

» **Impacts on indigenous natural vegetation (terrestrial)**
Construction of infrastructure may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of fynbos vegetation. The remaining natural vegetation on site is classified as Endangered, Vulnerable or Least Threatened. None of the turbines are proposed to be located within areas of remaining natural vegetation. This potential impact will, therefore, not occur. The significance of this impact is rated as zero and is not assessed further for this infrastructure component.

» **Impacts on wetlands**
Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. This will lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. The site contains a number of streams and drainage lines in which wetlands occur. More importantly, one of the major wetland systems on site constitutes part of the catchment for two estuaries on the coast downstream of the site (the Tsitsikamma and Krom River estuaries).

» **Establishment and spread of declared weeds and alien invader plants**
Major factors contributing to invasion by alien invader plants includes high disturbance and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away. A checklist of species previously recorded in the grid in which the site is located indicates that a number of species are likely to invade the site, given the right conditions.

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

Impacts are assessed for each component of infrastructure for the proposed wind energy facility. There is therefore a separate assessment for the turbines, substation, overhead power lines and the combination of underground cables between turbines and internal access roads.

Impact Assessment tables for Wind turbines:

Nature: Impacts on bat species of conservation concern

There is one near threatened bat species that could potentially be affected by the proposed wind energy facility. This is the Natal long-fingered bat. This species is most likely to be affected by the operation of the turbines to a greater extent than the installation of the turbines. No caves, mines or rock crevices were found on site, but there is a high likelihood of rock crevices being found in the low mountains to the north of the site. Cumulative impacts due to the high number of wind energy facilities proposed for the region may, however, be of concern.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» A pre-construction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site.
» If this pre-construction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme should be implemented to document the effect of wind turbines on bat species of concern.
» If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact.

Cumulative impacts:

Large number of other wind energy facilities proposed in this general area could result in a cumulative impact on bats that is more significant than any single facility.

Residual Impacts:

Likely.

Nature: Impacts on individuals of threatened animal species

Only the Fynbos Golden Mole, listed as Near Threatened, could potentially be negatively affected by the proposed infrastructure. The mole species is not mobile and, if it occurs on site, is likely to be affected by the construction of infrastructure since it is largely unable to move away during construction and is dependent on habitat remaining intact.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)

Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » None		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

Nature: Impacts on threatened plants

There are four threatened and two near threatened species that could occur in habitats away from the dunes in the southern parts of the site and could therefore be affected by proposed infrastructure. None of these species occur in disturbed habitats, which is where all the turbines are proposed to be placed. One species (*Protea coronata*) has been previously recorded at a number of locations close to the national road, although the accuracy of the latitude-longitude positions sourced requires verification considering the number of sitings in and around the study area that are within cultivated lands. Turbines are therefore unlikely to have an impact on populations of threatened or near threatened plant species, although there are potentially individuals of *Protea coronata* nearby.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Zero (0)
Probability	Probable (2)	Improbable (2)
Significance	**Low (12)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» As a precaution, a preconstruction survey for *Protea coronata* should be undertaken at the location of turbines 1, 2 and 3 to determine whether this species occurs within the footprint of these turbines or not.

» If any individuals occur there, viable seeds should be collected at the appropriate time of the year and sown within suitable nearby habitats. The best approach would probably be to cut off entire flowering branches and place them within suitable habitat.

Cumulative impacts:
None.
Residual Impacts:
None.

Nature: Impacts on Wetlands		
None of the turbines are currently positioned within mapped wetland areas.		
	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (2)	Highly probable (2)
Significance	**Low (26)**	**Low (26)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation:		
» Control stormwater and runoff water.		
» Obtain a permit from DWA to impact on any wetland or water resource.		
Cumulative impacts:		
Soil erosion, alien invasions, and increased frequency of veld fires may all lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts:		
None.		

Nature: Change in runoff and drainage leading to increased soil erosion and siltation of downslope areas		
Turbines 5, 8, 17 and 25 (refer to Figure 6.3) are located very close to the edge of wetlands / watercourses. The site of turbines 5 and 17 are heavily invaded and it was difficult to determine where the edge of the watercourse was in this degraded environment. A large concrete foundation may stabilise these degraded areas to some extent.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local and surroundings (2)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (16)**
Status (positive or negative)	Negative	Negative

Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Turbine 8 should be moved 30 m westwards along the existing access track » Turbine 25 should be moved 20 m south-west of its current position.		
Cumulative impacts: None.		
Residual Impacts: None.		

Nature: Establishment and spread of declared weeds and alien invader plants Turbines and associated infrastructure will create areas of disturbance, but this is within an already disturbed landscape in which aliens have already invaded extensively. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be very slightly enhanced, if at all.		
	Without mitigation	**With enhancement**
Extent	Site (1)	Site (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Medium (33)**
Status (positive or negative)	Negative	**Positive**
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as soon as possible after construction is complete in an area » Do not translocate soil stockpiles from areas with alien plants » Control any alien plants, especially within wetlands and watercourses » Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss and damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

Impact Assessment tables for overhead power line:

Nature: Impacts on individuals of threatened bat species No caves, mines or rock crevices were found on site, but there is a high likelihood of rock crevices being found in the low mountains to the north of the site. This species is not likely to be significantly affected by overhead power lines. Collisions with power lines may occur during times when individuals are not actively hunting and are not making use of echo-location.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (3)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Low (2)	Small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	None required	
Mitigation: None required		
Cumulative impacts: Any other infrastructure could cause similar impacts.		
Residual Impacts: None.		

Nature: Impacts on threatened terrestrial animal species The Fynbos Golden Mole is found in lowland fynbos and Knysna forest, also in urban areas. It prefers sandy soils with a deep litter layer. The dune area in the southern part of the site is highly suitable habitat for this species, although it could potentially occur in other parts of the site where suitable soil conditions occur. The power line will not cross this portion of the site and the likelihood of the impact occurring is therefore improbable.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (3)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Small (1)	Small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Not Reversible	Not Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be	Not required	

mitigated?		
Mitigation: None		
Cumulative impacts: Soil erosion and alien invasions may exacerbate this impact.		
Residual Impacts: Low.		

Nature: Impacts on threatened plants

There are four threatened and two near threatened species that could occur in habitats away from the dunes in the southern parts of the site and could therefore be affected by proposed powerline routes. One of these is listed as critically endangered (*Erica humansdorpensis*), one as endangered (*Osteospermum pterigoideum*, two as vulnerable (*Bobartia macrocarpa* and *Selago rotundifolia*) and two as near threatened (*Pauridia minuta* and *Protea coronata*). One species, *Bobartia macrocarpa*, listed as Vulnerable, was recorded on site on the farm Klip Rug and on the Remainder of farm 678. One species (*Protea coronata*) has been previously recorded at a number of locations close to the national road, although the accuracy of the latitude-longitude positions sourced requires verification considering the number of sitings in and around the study area that are within cultivated lands.

For power line Options B and C, any of these species could be affected. For power line Option A, there is an additional near threatened species (*Aloe micracantha*) that could be affected.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (32)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Undertake a pre-construction walk-through survey of the servitude of the selected power line route to determine whether any individuals of plant species of concern occur there or not.
» If possible, avoid affected populations by shifting power line tower structures slightly.
» Depending on the species potentially affected, other measures appropriate to the ecology of the species may be possible to mitigate impacts, for example collecting seed from the field and sowing it in suitable nearby habitat. A qualified botanist should be consulted in such cases and measures determined in consultation with relevant

authorities.
» If avoiding populations is not possible and any individuals of threatened species will be destroyed, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

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

Residual Impacts:
Low.

Nature: Loss of individuals of protected tree species
It is highly likely that there will be protected trees affected by construction of the power line.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:
» Undertake a walkthrough survey of the selected route, once tower positions are known, in order to determine the exact number of individuals of each species that will be affected.
» Obtain a permit for any protected trees that have to be destroyed in order to construct the power line.
» If large numbers of trees will be affected then additional biodiversity offsets or planting programmes may be required.

Cumulative impacts:
Impacts due to alien invasions and damage to watercourses may possibly cause damage to habitat where protected trees could grow that may exacerbate this impact.

Residual Impacts:
None.

Nature: Loss or fragmentation of indigenous natural vegetation
It is not expected that power line towers will have a major effect on natural vegetation, due to the small footprint of each tower structure and associated access road, but it is still possible that insensitive development could cause impacts.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Low (4) / moderate (6) (Option A)	Low to minor (3)
Probability	Highly probable (4) / Definite (5) (Option A)	Probable (3)
Significance	**Medium (36)** **Medium (55) (option a)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Align the power line as far as possible near to existing roads and tracks to minimize the need for construction or maintenance of additional service roads. » Avoid unnecessary impacts on natural vegetation surrounding the power line. » Disturbed areas must be rehabilitated as quickly as possible once construction is completed in an area.		
Cumulative impacts: Alien invasions, damage to wetlands and loss of habitat may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Some loss of natural vegetation type is likely to occur, but only a small extent is potentially at risk.		

Nature: Damage to wetlands & watercourses All the overhead power line options cross wetlands / watercourses in various places.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Partially	
Mitigation: » Place powerline tower structures a minimum of 50 m outside wetland boundaries, OR		

» Obtain a permit from DWA to impact on any wetland or water resource.
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree

Nature: Establishment and spread of declared weeds and alien invader plants
Power lines are situated primarily in previously disturbed parts of the landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be moderately enhanced.

	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4) / (moderate (6) (Option A)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)** **Medium (36) (Option A)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:
» Keep disturbance of indigenous vegetation to a minimum.
» Rehabilitate disturbed areas as quickly as possible.
» Do not translocate soil stockpiles from areas with alien plants.
» Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove.
» Establish an ongoing monitoring programme to detect and quantify any aliens that may become established.

Cumulative impacts:
Soil erosion and damage to wetlands may lead to additional impacts that will exacerbate this impact.

Residual Impacts:
Will probably be very low if control measures are effectively applied

Impact Assessment tables for Access roads and underground cables between turbines:

Turbines will be linked by a network of internal access roads, which is also the planned position of the underground cables linking the turbines to one another and to the internal substation.

Nature: Impacts on individuals of threatened bat species It is improbable that any impact will occur.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small (0)	Small (0)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (12)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: None.		
Residual Impacts: Unlikely to be residual impacts.		

Nature: Impacts on threatened terrestrial animal species Construction of internal access roads will lead to some loss of habitat for these species.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts:		

Likely to be residual impacts only if the impact actually occurs, which is considered unlikely.

Nature: Impacts on threatened plants

There are four threatened and two near threatened species that could occur in habitats away from the dunes in the southern parts of the site and could therefore be affected by proposed infrastructure. However, no infrastructure is proposed for these areas. Access roads to turbines are therefore unlikely to have an impact on populations of threatened or near threatened plant species, although there are potentially individuals of *Protea coronata* nearby.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (1)
Probability	Probable (2)	Improbable (2)
Significance	**Low (16)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» As a precaution, a preconstruction survey for *Protea coronata* should be undertaken at the location of the access roads to turbines 1, 2 and 3 to determine whether this species occurs within the footprint of these roads or not. If avoiding populations is not possible and any individuals of threatened species will be destroyed, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

» If any individuals occur there, viable seeds should be collected at the appropriate time of the year and sown within suitable nearby habitats. The best approach would probably be to cut off entire flowering branches and place them within suitable habitat.

Cumulative impacts:

None.

Residual Impacts:

None.

Nature: Impacts on indigenous natural vegetation

Access roads between turbines are not likely to affect areas of remaining natural vegetation. It should be possible to place them in such a way to avoid damage to natural vegetation, although it is possible that incorrect placement could cause an impact of this nature.

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

Significance	**Low (24)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Internal access roads must make use of existing roads on site, as far as possible.
» Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas.
» Where disturbance is unavoidable (considered unlikely), disturbed areas should be rehabilitated as quickly as possible once construction is completed in these areas.

Cumulative impacts:

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

Residual Impacts:

Some loss of this vegetation type will occur.

Nature: Impacts on wetlands

Internal access roads and underground cable alignments may require wetland crossings between turbines 30 and 31, 5 and 7, 11 and 15, near turbine 8, near turbine 17 and near turbine 25.

	Without mitigation	**With mitigation**
Extent	Local and surroundings (2)	Local and surroundings (2)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Control stormwater and runoff water and inhibit erosion.
» Disturbed areas must be rehabilitated as soon as possible after construction is complete in an area.
» Align internal access roads so that they branch directly from existing roads and go around wetlands as far as possible. If not possible, then the following measures must also be applied:
  a. Obtain a permit from DWA to impact on any wetland or water resource.
  b. Cross watercourses close to existing disturbances.

c. Cross watercourses perpendicularly, where possible, to minimize the construction footprint.
d. Adequate culvert and/or bridge structures are required at crossings.
e. Construction must not cause the width of the watercourse to be narrowed.

Cumulative impacts:

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

Residual Impacts:

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

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

Internal access roads will create areas of disturbance, but this is within an already disturbed landscape in which aliens have already invaded extensively. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be very slightly enhanced, if at all.

	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**+Medium (33)**
Status (positive or negative)	Negative	**Positive**
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

» Keep disturbance of indigenous vegetation to a minimum.
» Rehabilitate disturbed areas as quickly as possible.
» Do not translocate soil stockpiles from areas with alien plants.
» Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove.
» Establish an ongoing monitoring programme to detect and quantify any aliens that may become established.

Cumulative impacts:

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

Residual Impacts:

Will probably be very low if control measures are effectively applied

6.2.1. Implications for Project Implementation

The following recommendations are proposed to reduce or control potential impacts:

» As a precaution, a preconstruction survey for *Protea coronata* should be undertaken at the location of the turbines (and access roads to turbines) 1, 2 and 3 to determine whether this species occurs within the footprint of the infrastructure or not.
» Internal access roads must make use of existing roads on site, as far as possible.
» Turbine 8 should be moved 30 m westwards along the existing access track and turbine 25 should be moved 20m south-west of its current position.
» Align internal access roads so that they branch directly from existing roads and go around wetlands as far as possible. If not possible, then the following measures must also be applied:
  1) Obtain a permit from DWA to impact on any wetland or water resource.
  2) Cross watercourses close to existing disturbances.
  3) Cross watercourses perpendicularly, where possible, to minimize the construction footprint.
  4) Adequate culvert and/or bridge structures are required at crossings.
  5) Construction must not cause the width of the watercourse to be narrowed.
» Establish an ongoing monitoring programme to detect and quantify any aliens that may become established.
» Undertake a pre-construction walk-through survey of the servitude of the selected power line route to determine whether any individuals of plant species of concern occur there or not. If possible, avoid affected populations by shifting power line tower structures slightly.

6.2.2. Conclusions and Recommendations

The overall impacts of this proposed project on ecology are of low or moderate significance. With mitigation measures implemented, it should be possible to reduce all negative impacts to low or zero significance (through avoidance of impacts). In addition, there is an opportunity to have a positive impact on the site through judicious clearing and management of alien vegetation. Taking these factors into consideration, this project is supported from an ecological point of view.

The preliminary layout indicates that turbines will be placed in the northern two-thirds of the site and will not affect remaining areas of natural vegetation on site. The highly sensitive dune cordon in the southern part of the site will not be affected by the proposed project.

Factors that may lead to parts of the study area having high ecological sensitivity are the presence of wetlands within the drainage lines on site, potential presence of erodable substrates, the potential presence of various plant and animal species of conservation concern, and protected trees.

The drainage lines on site drain into two main systems that lead to the sea via the Klipdrif and Tsitsikamma Rivers. The site constitutes part of the catchment for these rivers. The mouths of the rivers have an estuary, which is considered to be very sensitive and is shown as having high conservation value and sensitivity in the ECBCP. The potential impacts of activities on site on these river systems need to be carefully managed. It is especially important that the estuaries are not affected by activities on site, for example, increased water turbidity due to erosion of substrates into upper reaches of watercourses.

Bat species of conservation concern for this site is the near threatened Natal Long-fingered Bat. The potential significance of impacts on this species was rated as medium. In order to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site, it is recommended that a preconstruction survey for bats should be undertaken. Further mitigation measures are proposed if this pre-construction survey delivers a positive result with respect to the presence of individuals or roosting sites at a level that may be of concern.

The site is currently heavily invaded by alien plants. This provides a unique opportunity for this project to have a positive impact on the local ecology. Effective clearing and management of alien trees in specific parts of the site could have a net positive impact on the ecological functioning of the site. The areas which could benefit strongly are watercourses and remaining patches of natural vegetation. The developer is encouraged to maximise this opportunity, which could be considered to be a biodiversity offset for potential impacts or even a net positive impact.

The proposed power line could potentially have various impacts, including on plant species of conservation concern, protected trees and natural vegetation, and could result in conditions that favour the introduction and/or spread of alien trees. The eventual impact would be very site-specific and may depend on which alignment is eventually selected. Within this alignment, there would be the opportunity to fine-tune the alignment and the position of tower structures to avoid many potential impacts. Appropriate measures are proposed to meet these objectives, including the undertaking of a pre-construction survey to identify any specific features of concern and their exact position.

In terms of the different power line alternatives provided, Option A to the Deep River substation has impacts of slightly greater significance than the other two

alignments, although it is shorter. This is due to the single block of natural area in the northern part of the alignment, whereas the **Option B** and **Option C** are preferred as they tend to cross only small patches of remaining natural vegetation. Although this alignment scores a slightly worse score than the other two alignments, it is by no means rejected as an alternative. Proposed mitigation measures could reduce impacts along all alignment options to the same significance, all of "low" significance.

6.3. Assessment of Potential Impacts on Avifauna

The identified impacts of the proposed facility on avifauna include:

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

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

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

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

Impacts of the proposed Wind Energy Facility are most likely to be manifest in the following ways:

(i) Disturbance and displacement of resident/breeding or non-breeding large terrestrial birds from nesting and/or foraging areas by construction and/or operation of the facility, and /or mortality of these birds in collisions with the turbine blades or the new power lines while commuting between resource areas (croplands, nest sites, roost sites/wetlands).
(ii) Disturbance and displacement of resident/breeding or visiting raptors from foraging areas by construction and/or operation of the facility, and /or mortality of these species in collisions with the turbine blades or the new power lines while flying/foraging in the area, or by electrocution when perched on power infrastructure.
(iii) Disturbance and displacement of the flight lines of wetland birds commuting between resource areas positioned either side of the proposed development

area and /or mortality of these birds in collisions with the turbine blades or the new power lines.

(iv) Disturbance and displacement of localised forest endemics – Knysna Woodpecker and Kynsna Warbler.

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

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

Nature: Disturbance during construction Noise, movement and temporary occupation of habitat during the building process. Likely to impact all birds in the area to some extent, but sensitive, sedentary and/or habitat specific species will most adversely affected.		
	Without mitigation	**With mitigation**
Extent	Site & immediate area (2)	Site & immediate area (2)
Duration	Short (1)	Short (1)
Magnitude	Medium-Low (4)	Low-Medium (3)
Probability	Definite (5)	Definite (5)
Significance	**35 (Moderate - Low)**	**30 (Low - Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Possible	Probably not
Can impacts be mitigated?	Yes	
Mitigation: » Abbreviating construction time. » Scheduling activities around avian breeding and/or movement schedules. » Lowering levels of associated noise. » Reducing the size of the inclusive development footprint. More detail is contained in the EMP (Appendix O).		
Cumulative Impacts: Possible, given that there are other wind energy projects proposed for the general area.		
Residual Impacts: Some priority species may move away regardless of mitigation.		

Nature: Habitat loss during construction Destruction of habitat for priority species, either temporary – resulting construction activities peripheral to the built area, or permanent - the area occupied by the completed development.

	Without mitigation	**With mitigation**
Extent	Site & immediate area (2)	Site & immediate area (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Definite (5)
Significance	**45 (Moderate)**	**40 (Moderate - Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Possible	Probably not
Can impacts be mitigated?	Yes	

Mitigation:

» Minimising habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible.
» Building as few temporary roads as possible and reducing the final extent of developed area to a minimum.

Cumulative Impacts:

Possible, given that there are other wind energy projects proposed for the general area.

Residual Impacts:

Some species may be permanently lost to the area regardless of mitigation.

Nature: Disturbance during operation

Noise and movement generated by operating turbines and maintenance activities is sufficient to disturb priority species, causing displacement from the area, adjustments to commute routes with energetic costs, or otherwise affecting nesting success or foraging efficiency.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Lifetime of the facility (4)	Lifetime of the facility (4)
Magnitude	Medium (6)	Medium-Low (5)
Probability	Highly probable (4)	Highly probable (4)
Significance	**48 (Moderate)**	**44 (Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Possible	Possible
Can impacts be mitigated?	Slightly	

Mitigation:

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

Cumulative Impacts:
Possible, given that there are other wind energy projects proposed for the general area.
Residual Impacts:
Some priority species may be permanently lost from the area.

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

	Without mitigation	**With mitigation**
Extent	Medium (3)	Low-Medium (2)
Duration	Lifetime of the facility (4)	Lifetime of the facility (4)
Magnitude	Medium-High (7)	Medium (6)
Probability	Highly probable (4)	Probable (4)
Significance	**56 (Moderate)**	**48 (Moderate)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Possible
Can impacts be mitigated?	Yes	

Mitigation:
» Careful siting of turbines.
» Marking power lines in identified sensitive areas.
» Use of bird friendly power hardware.
» Monitoring priority bird movements and collisions. Turbine management is sensitive to these data. This monitoring should be radar assisted if necessary

Cumulative Impacts:
Possible, given that there are other wind energy projects proposed for the general area.

Residual Impacts:
Some priority species may be permanently lost from the area.

6.3.1. Implications for Project Implementation

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

» Minimising the disturbance impacts associated with the construction of the facility, by abbreviating construction time, scheduling activities around avian breeding and/or movement schedules (actual timing to be refined by the results of pre-construction monitoring), and lowering levels of associated noise. Possible Denham's Bustard and Blue Crane nest sites are particularly relevant here.
» Minimising habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible, building as few temporary

roads as possible, and reducing the final extent of the developed area to a minimum.

» Minimising the disturbance impacts associated with the operation of the facility, by abbreviating maintenance times, scheduling activities in relation to avian breeding and/or movement schedules (actual timing to be refined by the results of pre- and post-construction monitoring), and lowering levels of associated noise. Possible Denham's Bustard and Blue Crane nest sites are particularly relevant here.

» Ensuring that lighting on the turbines is kept to a minimum, and is coloured (red or green) and intermittent, rather than permanent and white, to reduce confusion effects for nocturnal migrants.

» Minimising the length of any new power lines installed, ensuring that all new lines are marked with bird flight diverters along their entire length, and that all new power line infrastructure is adequately insulated and bird friendly in configuration. Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line. The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.

» Carefully monitoring the local avifauna both pre- and post-construction, and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded for any of the priority species listed in this report. An essential weakness of the EIA process here is the dearth of knowledge about the actual movements of key species (bustards, cranes, eagles, other raptors, storks) through the impact area. Such knowledge must be generated as quickly and as accurately as possible in order for this and other wind energy proposals in the area to proceed in an environmentally sustainable way.

» Ensuring that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of other wind energy projects proposed for the same general area. Viewed in isolation, each of these projects may pose only a limited threat to the avifauna of the region. However, in combination they may result in landscape-scale displacement of threatened species from key areas of their distributions, the formation of significant barriers to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become repeated arrays of

turbines spread across foraging areas and/or flight paths of priority species. The broader, coastal plain area around Humansdorp/Jeffrey's Bay/Cape St Francis is clearly of considerable importance to the regional status of Denham's Bustard. Should this species be substantially impacted by either displacement or mortality associated with facility development, cumulatively this could have a bearing on the national conservation status of this already threatened bird. Hence there is a strong requirement for careful monitoring and comprehensive mitigation.

» Additional mitigation might include re-scheduling construction or maintenance activities on site, shutting down problem turbines either permanently or at certain times of year or in certain conditions, or installing a 'DeTect' or similar radar tracking system to monitor bird movements and institute temporary shut-downs as and when required.

6.3.2. Conclusions and Recommendations

The primary concern for the proposed facility in terms of avifauna will be that of collision of birds with the turbines and earth wires of the power lines. This impact on avifauna is potentially of medium - high significance, but could be reduced to a medium significance with the implementation of mitigation measures. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined (refer to the EMP in Appendix O), from pre-construction and into the operational phase of the project.

Power Line Route Option A to Diep Rivier substation is preferred from an avifaunal perspective due to its comparatively short length.

Power Line Route Option B is the preferred option for linking to the Melkhout substation due to its shorter length when compared to Power Line Route Option C.

This is a medium-sized wind energy project, proposed for a site with some conflicting issues in terms of its avifauna. The proposed development will possibly affect populations of regionally or nationally threatened (and impact susceptible) birds (mainly large terrestrial species and raptors) likely to occur within or close to the proposed turbine arrays. The facility will probably have a detrimental impact on these birds, particularly during its operational phase, unless commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South African avifauna. The impacts of this development must be viewed in the context of the potential cumulative

effects generated by multiple other wind energy project proposed for the same general area. The cumulative impact of these projects on the utility of the area for Denham's Bustard is of particular concern.

6.4. Assessment of Potential Impacts on Geology and Soils

The construction of the proposed wind energy facility and associated infrastructure will tend to involve minor earthworks on localised, small construction footprints around each turbine or the substation with interlinking gravel access roads. The proposed activity may potentially cause a negative direct impact on degradation of soil, rock and/or landforms. The proposed activity could also result in negative indirect impacts, such as increased siltation in waterways downstream from the site or dust pollution in the area surrounding the site. The severity or significance of the various impacts is related to the nature and extent of the activity.

The most important issues are the direct impacts of soil degradation and erosion of topsoil from the area of activity. This would affect the ecosystems operating in the topsoil and the plant and animal species that depend on it for growth and survival.

The proposed activity may potentially result in all or some of the negative direct impacts. The proposed activity could also result in negative indirect impacts, such as increased siltation in waterways downstream from the site or dust pollution in the area surrounding the site. The severity or significance of the various impacts is related to the nature and extent of the activity.

Soil erosion is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and/or physical transport on the land surface. Soil erosion induced or increased by human activity is termed "accelerated erosion" and is an integral element of global soil degradation. Accelerated soil erosion is generally considered the most important geological impact in any development due to its potential impact on a local and regional scale (i.e. on and off site) and as a potential threat to global agricultural potential. Soil erodability – the susceptibility of soil to erosion – is a complex variable, not only because it depends on soil chemistry, texture, and characteristics, but because it varies with time and other variables, such as mode of transport (i.e. wind or water).

Erosion of soil due to water run-off is generally considered as more important due to the magnitude of the potential impact over a relatively short period of time which can be very difficult to control. Erosion by water occurs when the force exerted on the soil by flowing water exceeds the internal shear strength of the soil and the soil fails and becomes mobilised into suspension. Erosion potential is

typically increased in areas where soil is loosened and vegetation cover is stripped (e.g. construction sites). Erosion sensitivity can be broadly mapped according to the severity of the potential erosion if land disturbing activities occur and this is generally related to the geology, soil types and the topography. Generally speaking, unconsolidated or partly consolidated fine-grained soils of low plasticity along drainage lines and on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of erosion due to water run-off. These areas are typically called "highly sensitive" areas.

All natural drainage lines on site have been indicated as having moderate sensitivity in terms of potential impacts on soils. These are not absolute no-go areas but special engineering measures will be required in these areas.

Excavations for foundations, underground cabling and access roads in areas where shallow bedrock occurs will have a negative impact on the bedrock. However, the excavations are likely to be restricted and to a depth of less than a few meters which will have minimal effect on the surroundings. Excavations for access roads in areas with steep and rugged terrain may involve significant road cuttings which may result in unsightly scars on the hillside. Road cuttings can also lead to slope instability if not engineered properly, resulting in further degradation of the landscape. Degradation of the natural topography can also lead to changes in the hydrology and groundwater regime of the surroundings. Generally speaking the degradation to the site geology is not considered to be too problematic as the topographic relief is low to moderate.

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

Nature: Soil degradation – Excavation and removal of soil for roads, cabling and structures.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (45)**	**Low (25)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, to a certain extent.	
Mitigation: » Use existing roads where possible.		

» Design platforms, lay-down areas and roads according to contours to minimise cut and fill operations. » Restrict activity outside of authorised construction areas. » Rehabilitate soil after construction.
Cumulative impacts: The cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area.
Residual impacts: Minor negative – slow regeneration of topsoil.

Nature: Soil degradation – Loosening, mixing, wetting & compacting of in situ soil during earthworks.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (50)**	**Moderate (35)**
Status	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Use existing roads where possible. » Design platforms and roads according to contours to minimise cut and fill operations. » Restrict activity outside of construction areas. » Rehabilitate soil after construction.		
Cumulative impacts: The cumulative impact of earthworks in the area is considered low due to the undeveloped nature of the area.		
Residual impacts: Minor negative – slow regeneration of vegetation & soil.		

Nature: Soil degradation – Pollution of soil by contaminants (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)

Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Control use and disposal of potential contaminants or hazardous materials. » Remove contaminants and contaminated topsoil and replace topsoil in affected areas.		
Cumulative impacts: The cumulative impact of soil pollution is considered low due to the undeveloped nature of the study area.		
Residual impacts: Minor negative – slow regeneration of soil processes in and under topsoil		

Nature: Soil degradation – Soil erosion by wind and water.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	Irreversible	Practically irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Minimise construction footprint area. » Restrict activity outside of construction area. » Implement effective erosion control measures. » Carry out earthworks in phases across site to reduce the area of exposed ground at any one time. » Keep to existing roads, where practical, to minimise loosening of natural ground. » Protect and maintain denuded areas and material stockpiles to minimise erosion and instability		
Cumulative impacts: The cumulative impact of soil erosion in the area is considered low due to the undeveloped nature of the area.		
Residual impacts: Minor – Localised movement of sediment. Slow regeneration of soil processes		

Nature: Reduction in soil erosion by water as a result of improved drainage and control of run-off.		
	Without Enhancement	***With Enhancement***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Very probable (4)	Very probable (4)
Significance	**Moderate (36)**	**Moderate (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	
Can impacts be enhanced?	No.	
Enhancement: » None		
Cumulative impacts: None		
Residual impacts: N/A		

Nature: Increased siltation of drainage lines and watercourses downstream from site (Indirect Impact)		
	Without mitigation	***With mitigation***
Extent	Regional (3)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Install anti-erosion measures such as silt fences, geosynthetic erosion protection and/or flow attenuation along watercourses below construction sites. » Strictly controlled activity near water courses/natural drainage lines as sediment transport is higher in these areas.		
Cumulative impacts: The cumulative impact of siltation in the area is considered low.		
Residual impacts: Minor localised movement of soil across site		

Nature: Dust pollution from construction site affecting areas surrounding site.		
	Without mitigation	***With mitigation***
Extent	Regional (2)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (16)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, low	Yes, minor
Can impacts be mitigated?	Yes	
Mitigation: » Place dust covers on stockpiles. » Use suitable gravel wearing course on access roads. » Apply straw bales or dampen dusty denuded areas.		
Cumulative impacts: The cumulative impact of dust in the area is considered low.		
Residual impacts: Minor localised movement of soil across site		

6.4.1. Implications for Project Implementation

» The most important impacts on geology and soils include soil degradation (including erosion).
» The main direct impacts will be localised and limited to the extent of the proposed activity.
» The underlying geology of the site appears to be generally favourable towards the proposed layout.
» Unconsolidated or partly consolidated fine-grained soils of low plasticity along drainage lines and on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of erosion due to water run-off. These areas are typically called "highly sensitive" areas and require control measures to be implemented.
» Excavations for access roads in areas with steep and rugged terrain may involve significant road cuttings which may result in unsightly scars on the hillside. Road cuttings can also lead to slope instability if not engineered properly, resulting in further degradation of the landscape.
» Natural drainage lines should be considered no-go areas.

6.4.2. Conclusions and Recommendations

The findings of the geology and soils study indicate the most important impacts on geology and soils include soil degradation (including erosion). The significance of the main direct impacts that have been identified is considered low to moderate due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout.

The potential negative impacts on the geological environment are considered to have a low to moderate significance. With effective implementation of mitigating measures these impacts identified above can be reduced to a low significance.

The potential positive impacts on the geological environment are considered to have a moderate significance on a local scale but the cumulative impact of a reduction in demand and extraction/mining of non-renewable energy sources on a national scale is very significant. No insurmountable problems or "fatal flaws" which have may have an impact on the design and construction processes.

The underlying geology is very similar for all three alternative power line routes. **Alternative A** to Diep Rivier Substation is preferred while **Alternative B** is the most preferred in the event of connecting to Melkhout Substation due to the shorter distances covered and the corresponding lower impact significance due to less infrastructure.

6.5. Assessment of Potential Impacts on Soils & Agricultural Potential

The presence of pastures and cattle production has already lead to significant impact on the site relating to erosion and sediment generation as well as eutrophication (algal growth). For the development of the wind energy facility, the overall soil impacts are expected to be relatively low for the shallow soil zones but will be very high for areas with established irrigation infrastructure. Impacts are generally restricted to small areas around the turbine foundation as well as the transmission and road infrastructure. Erosion control measures will have to be implemented to prevent and contain erosion associated with soil surface disturbance due to construction activities.

The landscape on the site has been divided into areas of different sensitivity (low, medium and high) as a function of land use, agricultural use and wetland zones (Figure 6.4). From this map it is evident that some turbines fall within areas of high and medium sensitivity (turbines 17 and 25). Some of the turbines are situated on the edge of potential wetland zones and may need to be excluded once a dedicated wetland delineation study has been conducted.

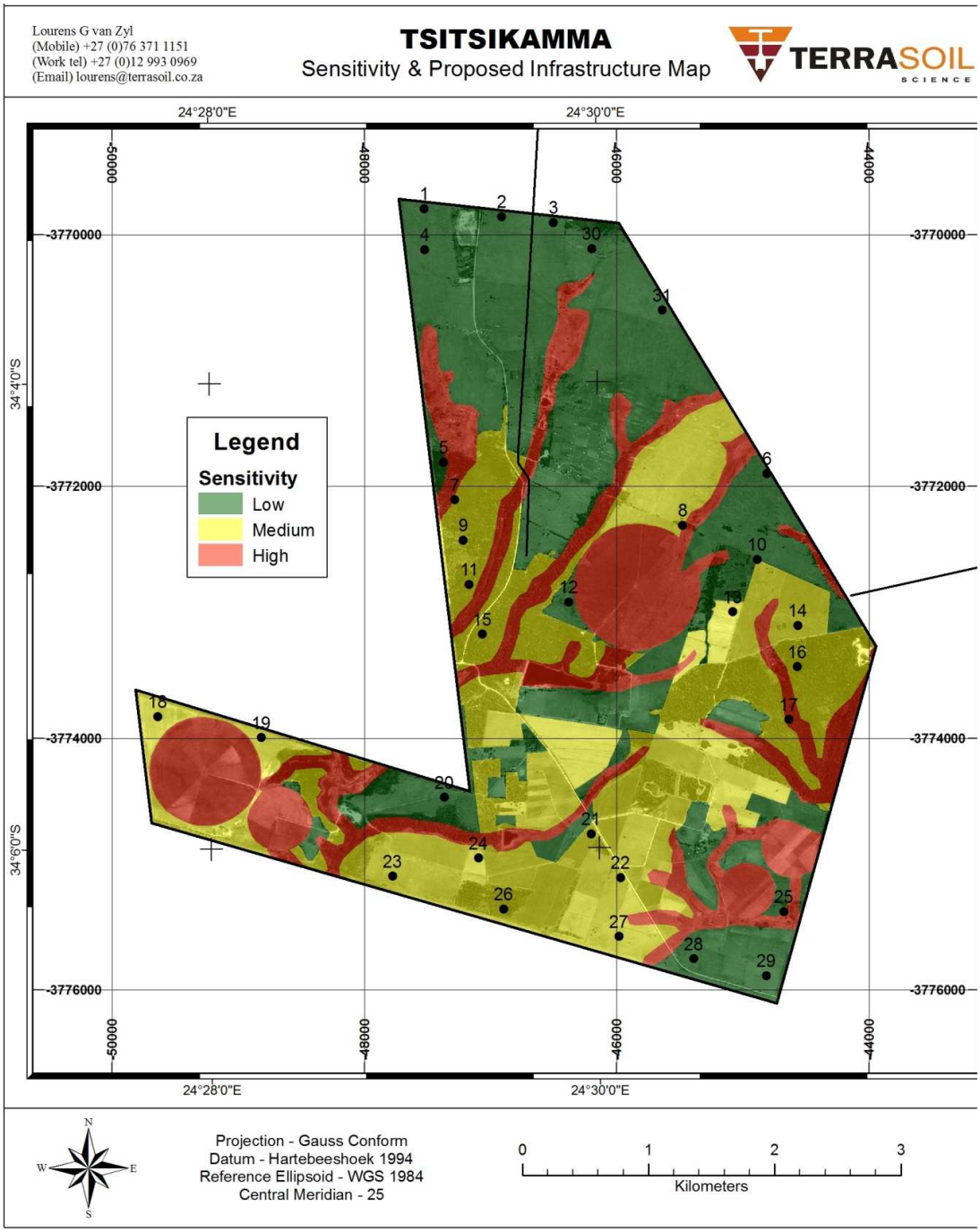

Figure 6.4: Soils and land use sensitivity of the site

Impact table summarising the significance of impacts on soils & agricultural potential (with and without mitigation)

Nature: Construction of turbine foundations impacting on soils		
	Without mitigation	***With mitigation***
Extent	Low (1) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**16 (Low)**	**16 (Low)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but indirect impacts can be minimised and avoided through adequate planning of layout	
Mitigation: » The loss of agricultural land is a long term loss and there are no mitigation measures that can be put in place to combat this loss. Mitigation is restricted to the limitation of the extent of the impact to the immediate area of impact and minimisation of off-site impacts		
Cumulative impacts: Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures should be implemented.		
Residual impacts: The loss of agricultural land is a long term loss. This loss extends to the post-construction phase. The agricultural potential is variable though and negative impacts can be limited through adequate planning for the layout.		

6.5.1. Implications for Project Implementation

It is concluded that the proposed development of a wind energy facility on the site will have potentially large impacts in areas of high sensitivity and these areas are therefore considered no-go areas for development.

Regarding the construction of turbines and associated infrastructure the following recommendations are made:

» Limit physical impacts to as small a footprint as possible;
» Site management has to be implemented with the appointment of a suitable environmental control officer (ECO) to oversee the process, address problems and recommend and implement corrective measures;
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads);

» Plan the road and site layout in such a way as to make maximal use of existing roads and fence/border areas to minimise impacts and to keep grazing and natural units as intact as possible; and
» Prevent dust generation and vehicle associated pollution and spillages.

6.5.2. Conclusions and Recommendations

The current land use of cattle production on irrigated fields has impacted negatively on wetlands and has the potential to add to eutrophication of surface water sources. It is recommended that land users prevent cattle trampling of soil in drainage depressions and that natural wetland vegetation be re-established in these lines. The loss of agricultural land is a long term loss and there are no mitigation measures that can be put in place to combat this. Mitigation is restricted to the limitation of the extent of the impact to the immediate area of impact and minimisation of off-site impacts.

The impacts on the site need to be viewed in relation to the opencast mining of coal in areas of high potential soils – such as the Eastern Highveld. With this comparison in mind the impact of a wind energy facility is negligible compared to the damaging impacts of coal mining – for a similar energy output. Therefore, in perspective, the impacts of the proposed facility can be motivated as necessary in decreasing the impacts in areas where agriculture potential plays a more significant role.

There is **no preference** in terms of the proposed power line route options.

6.6. Assessment of Potential Impacts on Heritage Sites and Palaeontology

» *Pre-Colonial Archaeology*
Most of the proposed area for the construction of the Tsitsikamma Community Wind Energy Facility is further than five kilometres from the coast and falls outside the maximum distance coastal archaeological features such as shell middens are expected to be located from the beach. Apart from a few Earlier and Middle Stone Age stone tools, no other archaeological sites/materials were observed and in general the area appears to be of low archaeological sensitivity. Previous surveys in the wider area identified Earlier and Middle Stone Age stone tools in the exposed river gravels and surrounding hill tops throughout the region, but these were in secondary context and not associated with any other archaeological materials. However, sites/materials may be covered by soil and grass and there is always a possibility that human remains and/or other archaeological material may be uncovered during the development.

Construction of the turbine foundations, substation, cabling between the turbines and access roads may impact on remains which are buried and not visible, but these impacts will be limited and restricted to the local area. Deep excavations for the turbine foundations will also have limited impact on possible buried remains because the top soil is shallow which do not allow for deep archaeological deposits.

» *Pre-colonial archaeological cultural landscape*

The significance of the pre-colonial archaeology between Klasies River in the west and Cape St Francis in the east, has been illustrated by research over many years and more recently by a Heritage Impact Assessment conducted at Thyspunt for the proposed nuclear power facility site (ACO 2010). The importance of the archaeology of the region was maintained by SAHRA when they recently ruled on the proposed nuclear site at Thyspunt, that within their mandate they,

… cannot approve any developments that will have a major deleterious effect on the heritage of a highly significant cultural landscape such as Thyspunt. It is the belief of the SAHRA that the impact on the heritage resources will be too severe and that that mitigation will not achieve the desired effect (SAHRA 2010, Review comments on the Environmental Impact Assessment for three proposed nuclear power station sites and associated infrastructure: Heritage Impact Assessment: Archaeological Component).

However, Thyspunt is only a small part of the much larger and elaborate pre-colonial cultural landscape which is situated between Klasies River (previously also known as the Kaapsedrift River) in the west to Cape St Francis/Kromme River Mouth in the east. For the purpose of this report only the western part will be discussed with references to the central Thyspunt part.

Approximately between two and three kilometres south-west from the nearest turbine locations of the Tsitsikamma Community Wind Energy Facility is the Geelhoutboom dunes. These fossil dunes were part of a Plio-Pleistocene headland bypass system. The bulk of the artefacts in this area are from the Middle Stone Age and densities of upwards of 50 artefacts per square metre have been observed. The exposures which are several kilometres in length and several hundred metres in width, is the largest artefact scatter observed along this part of the south-eastern Cape coast (Deacon & Geleijnse 1988).

The Klasies River/Klippepunt area represents one of the most unique pre-colonial cultural landscapes in the world. Anatomically modern human populations most probably originated here in the wider region and spread to Europe and other parts of the globe. Notwithstanding, a wind farm facility which includes 53 turbines and situated inside this pre-colonial archaeological

cultural landscape has been approved for development. The proposed Tsitsikamma Community Wind Energy Facility development which includes 31 turbines is located inland from this project. The increase of a large number of turbines in the area will contribute to significant changes to the cultural landscape of the area as well as an overall 'sense of place'.

» *Fossils*

The construction phase of the development will entail substantial excavations into the superficial sediment cover (soils etc) and perhaps also into the underlying bedrock. These notably include excavations for the turbine foundations, buried cables, new internal access roads and foundations for associated infrastructure such as a substation and workshop / administration building. In addition, sizeable areas of potentially fossiliferous bedrock may be sealed-in or sterilized by infrastructure such as hard standing areas for each wind turbine, lay down areas and access roads. All these developments may adversely affect potential fossil heritage within the study area by damaging, destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

At the present stage of assessment, without applying the precautionary principle, the impact significance of the construction phase of the proposed wind farm project is assessed as **moderate** (negative) as far as fossil heritage is concerned. There are no fatal flaws in the development proposal on these grounds and mitigation is very likely to reduce the impact significance levels to **low**. Alternative sites or site plans are not under consideration at this stage.

The degree of confidence in the paleontological assessment is only moderate, however, due to inadequate paleontological and geological field data for the study area near Humansdorp. Providing that the recommended mitigation measures are carried through, it is likely that the potentially negative impacts of the proposed development on local fossil resources will be substantially reduced and, furthermore, they will partially offset by the positive impact represented by increased understanding of the paleontological heritage of the Humansdorp region.

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

Nature: Disturbance to possible archaeological sites The potential impact of the construction of the turbines, substation, cabling between the turbines, access roads and workshop on above and below ground archaeology.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)

Magnitude	Minor (2)	Minor (1)
Probability	Unlikely (2)	Unlikely (2)
Significance	**Low (16)**	**Low (14)**
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	In some cases	In some cases
Can impacts be mitigated?	Yes	

Mitigation measures:

» No mitigation is proposed before construction starts because the archaeological remains on site (if any) are of low significance (excluding human remains). However, if concentrations of archaeological materials are exposed then all work must stop for an archaeologist to investigate (see below).

» If any human remains (or any other concentrations of archaeological heritage material) are exposed during construction, all work must cease and it must be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency, so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material. Recommendations will follow from the investigation.

Cumulative impacts:
Low

Residual impacts:
None

Nature: Impacts to the pre-colonial cultural landscape
The large number of turbines will impact on one of the most unique pre-colonial cultural landscape in the world in terms of visual impacts and changes to 'sense of place'.

	Without mitigation	**With mitigation**
Extent	Local (4)	Local (3)
Duration	Long term/permanent (5)	Long term/permanent (5)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Highly probable (3)
Significance	**Moderate (68)**	**Low (48)**
Status (positive or negative)	Negative	Neutral
Reversibility	Yes	Yes
Irreplaceable loss of resources?	In some cases	In some cases
Can impacts be mitigated?	Yes	

Mitigation measures:

» It is recommended that due to the significance of the pre-colonial cultural landscape, the closest turbines (18-29) be pushed further inland to reduce the accumulative visual effect.

Cumulative impacts:
The cumulative impacts may be increasing as further wind farms are planned for adjoining areas. The large number of turbines will bring permanent changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place'.
Residual impacts:
None

Nature: Disturbance or destruction of valuable fossil heritage

Disturbance, damage, destruction or sealing-in of fossil remains preserved on or beneath the ground surface within the development area, notably by bedrock excavations during the construction phase of the wind energy facility.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**30 (Medium)**	**Low (24)**
Status (positive or negative)	Negative	
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Pre-construction (Phase 1) field assessment of broader development area (all land parcels) including development footprint by professional palaeontologist to identify possible zones or areas of high palaeontological sensitivity and to recommend any further mitigation measures deemed necessary, such as:

» Recording and judicious sampling of fossil heritage and relevant geological data within development footprint during the construction phase;
» Monitoring of all substantial bedrock excavations for fossil remains by ECO, with reporting of new finds to SAHRA for possible specialist mitigation.

Cumulative impacts:

Unknown (Insufficient data on local wind farm developments available)

Residual Impacts:

Partially offset by positive impacts resulting from mitigation (i.e. improved palaeontological database).

6.6.1. Implications for Project Implementation

The proposed Tsitsikamma Community Wind Energy Facility site is situated approximately 5km from the coast and some 6km north-east from the Klasies River Complex of caves (from the nearest turbine), on the landward edge of the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape. In recent years several large developments have been proposed for this region of the south-eastern Cape coast. Apart from the proposed nuclear power station

development at Thyspunt, there are also several wind energy facilities proposed for the region and two in the immediate area have already been approved for development. One of the wind energy developments is situated adjacent to the Thyspunt cultural landscape, and has been approved with the condition that two turbines are constructed further inland. The other wind energy facility, which includes 53 turbines, is situated inside the pre-colonial archaeological cultural landscape between the Tsitsikamma Community Wind Energy Facility site and the coast (Van Ryneveld 2010). All these proposed developments will have a cumulative effect on the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape, not only in terms of the disturbance of archaeological heritage sites/materials, but also in terms of the visual impact and changes to 'sense of place'.

To decrease the cumulative impacts and effects on the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape, it is recommended that:

» If any concentrations of archaeological material or human remains are uncovered during further development of the site, all work must immediately cease and must be reported to the Albany Museum and/or the South African Heritage Resources Agency so that systematic and professional investigation/excavations can be undertaken. Sufficient time should be allowed to remove/collect such material.
» Construction managers/foremen should be informed before the start of construction on the possible types of heritage sites and cultural material they may encounter and the correct procedures to follow when they encounter sites.

It is recommended that a Phase 1 pre-construction field assessment by a professional palaeontologist of the broader development area, including the final development footprint, be carried out to (a) identify any zones or areas of high palaeontological sensitivity and (b) to recommend any mitigation measures deemed necessary. If fossil-rich rocks are identified within the development footprint, further (Phase 2) palaeontological mitigation is likely to involve:

» Recording and judicious sampling of fossil heritage and relevant geological data within the development footprint during the construction phase;
» Monitoring of all substantial bedrock excavations for fossil remains by the ECO;
» In the case of any significant fossil finds (e.g. shell beds, vertebrate teeth, bones, burrows, petrified wood) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (SAHRA) so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense.

The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies currently being developed by SAHRA.

6.6.2. Conclusions and Recommendations

Research along the Klasies River/Cape St Francis coastal zone indicated that shell middens and other archaeological features occur up to 5km inland. Based on this observation the pre-colonial cultural landscape is set at this distance from the coast which provide the criteria for recommendations for developments along the south-eastern Cape coast, including the current proposed Tsitsikamma Community Wind Energy Facility site. If the distance of 5km from and parallel to the coast is accepted for the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape, then the current positions of a number of turbines are on or close to the boundary. Due to the size and visibility of the turbines it is impossible to 'shade/hide' their dominate influence in the environment, but the impact on the pre-colonial archaeological cultural landscape can be 'softened' by reducing the number of turbines and/or pushing them back further inland by 2 km. To lessen the visual impact, turbines 18 - 29 could be constructed further inland. However as confirmed by the Visual Impact Assessment findings (Appendix L) the visual impact on the Thuyspunt Natural Heritage Site will be of low significance and the shifting of turbines away from the coastline will not significantly lessen the visual impact. This mitigation option is therefore not supported by the findings of this EIA report.

Impacts of wind energy projects on fossil heritage are generally direct, negative, of local significance and confined to the construction phase. Fossils preserved at or below the land surface may be disturbed, damaged, destroyed or sealed-in by developments such as excavations for wind turbine foundations, access roads and ancillary infrastructure. It is recommended that a Phase 1 pre-construction field assessment by a professional palaeontologist of the broader development area, including the final development footprint, be carried out.

While **Option A** is preferred, any of the proposed power line routes are acceptable from a heritage and palaeontology perspective.

6.7. Assessment of Potential Visual Impacts

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

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

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

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

The visibility map below (Figure 6.5) clearly illustrates the influence of the topography and the placement of the wind turbines along the ridgeline on the potential frequency of exposure. The proposed facility is placed in an elevated position relative to the surrounding landscape, which means it can be viewed from a large area and that a large number of turbines can be viewed at any one time.

The result of the viewshed analyses for the proposed Tsitsikamma Community Wind energy Facility's provisional layout is shown below in Figures 6.5

The viewshed analysis not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The dark orange areas indicate a high frequency (i.e. 28-31 turbines may be visible) while the yellow areas represent a low frequency (i.e. 1-3 turbines may be visible).

The highest frequency of potential visual exposure is on the site itself and on the coastal plain to the immediate west and east of the site. The areas lying above the plateau to the north are mostly screened by the high-lying topography.

Long strips along the numerous drainage lines in close proximity to the site are screened as incision by the rivers into the landscape effectively shields these areas from potential visual exposure. The Krom River valley also offers large areas of visual screening due to topography. Similarly, many areas along the coastline are visually screened as the landscape drops down to sea level.

Beyond the Krom River to the north east, the frequency of visual exposure appears to increase with distance from the proposed facility. This is due to the rising topography, and specifically the south facing slopes of the mountains, which orientate towards the proposed site.

Visibility of the facility will be high, with a high frequency of exposure for stretches of the N2 and the R102, especially below the plateau in close proximity to the proposed facility. Beyond the plateau to the north, the frequency of exposure first drops to low, and then increases to moderate.

Shorter stretches of the R330 and of the R62 in the vicinity of Diep Rivier Distribution Substation will be exposed to lower frequencies of potential visual exposure. The R331 and R332 will not be exposed.

The towns of Kruisfontein and Humansdorp to the north east, Oyster Bay to the south east and Clarkson to the north west are expected to experience a moderate to high frequency of visual exposure, both within the towns and in the surrounding area.

The western parts of Jeffrey Bay and the outskirts of Sea Vista are likely to experience lower frequencies of potential visual exposure. It should be noted, however, that these two towns are located more than 20km from the proposed facility.

In addition, a large number of settlements and homesteads, especially those located below the plateau will be potentially visually exposed, with a high frequency of exposure.

The proposed facility may also be visible from limited parts of the Thaba Manzi, the Jumanji and Lombardini Game Farms, as well as the Thyspunt Natural Heritage Site and the State Forest. Very limited parts of the Kromrivierspoort National Heritage Site, the Huisklip Nature Reserve and Klasies River Cave may be exposed to moderate to high frequencies of potential visual exposure.

The visibility map clearly illustrates the influence of the topography, and specifically the visual screening the plateau offers the facility which is located on the low lying coastal plain.

It is envisaged that the wind turbine structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing at homesteads or visiting the region), especially within a 5km to 10 km radius (i.e. at short to medium distances) of the facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

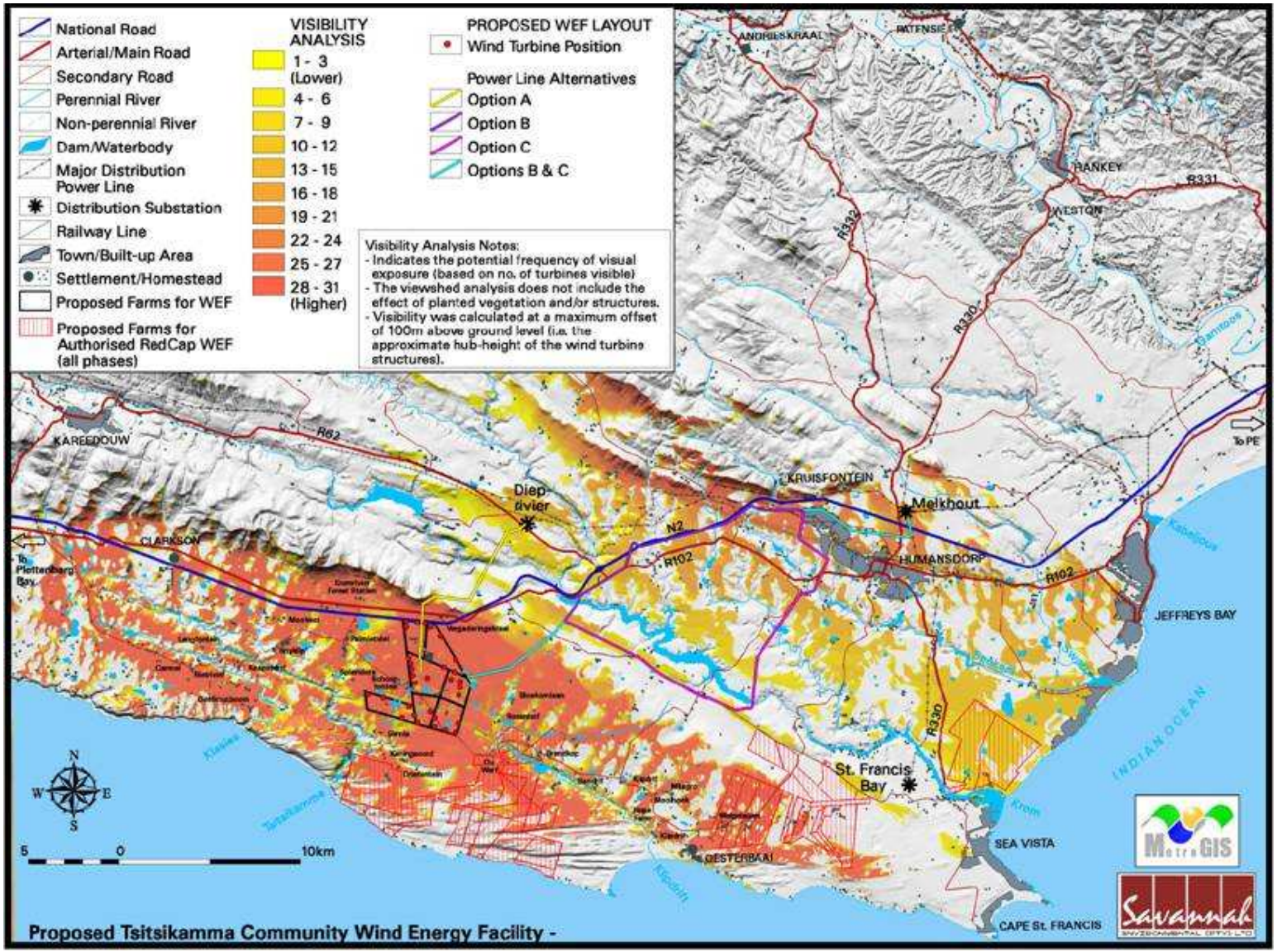

Figure 6.5 Potential visual exposure of the proposed facility.

» **Visual Impact Index - wind energy facility**

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed wind energy facility are displayed in Figure 6.6 Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater magnitude) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map clearly indicates a core area of potentially high visual impact on the site itself and within a 5 km radius of the proposed facility. This core area is located mostly on the coastal plain below the plateau, and stretches almost to the coastline. The northern part lies above the plateau and is not exposed to visual impact. Potential areas of **very high** visual impact within this 5km radius include the N2, the R102 and the secondary road to Oyster Bay. In addition, as a number of settlements and homesteads are likely to experience very high visual impact. These homesteads and settlements include the following:

* Kromrivier;
* Forest Station;
* Moolwei;
* Palmietvlei;
* Snyldip;
* Kaapsedrif;
* Splendora;
* Schoonfontein;
* Samia;
* Koningsoord;
* Driefontein;
* Werf;
* Rosenhof;
* Bloekomslaan and
* Vergadringkraal.

Very limited parts of the Kromrivierspoort National Heritage Site the Huisklip Nature Reserve will be exposed to moderate visual impact, while the State Forest below the plateau falls within the zone of high visual impact.

The extent of potential visual impact is somewhat reduced between the 5km and 10km radius. Areas to the north above the plateau remain largely shielded, except for the areas in the vicinity of the Diep Rivier Distribution Substation, which are likely to experience **low** visual impact.

Areas of **moderate** visual impact include interrupted stretches of the N2, the R102 and the R62 (above the plateau), and the agricultural land to the west and the east of the site. Due to the undulating topography and incised river valleys, the areas of potential visual exposure are patchy (i.e. as opposed to expansive and continuous).

Short stretches of the N2, the R102 and the secondary road to Oyster Bay are likely to experience a **high** visual impact within this zone. These stretches are limited to the coastal plain, below the plateau.

No towns or urban areas occur within this zone, but a number of homesteads and settlements are likely to experience a **high** visual impact. These lie, which lie between 5km and 10km of the proposed facility include the following:

* Langfontein;
* Rietrivier;
* Geelhoutboom;
* Brandkop;
* Sanddrif and
* Klipdrif.

Limited parts of the Jumanji Game Farm may be exposed to low visual impacts, while small sections of Klasies River Cave and larger parts of the State Forest (below the plateau) may be exposed to moderate visual impact. Between 10km and 20km, the extent of potential visual impact increases in the north east, on the high-lying south facing slopes. The magnitude of visual impact is, however, mostly reduced to **low** within this zone. Exceptions are short stretches of the N2, the R102 (both to the west and north east of the site) and various secondary roads. The towns of Oyster Bay and Clarkson, as well as a number of homesteads and settlements also fall within this zone ad are likely to be visually exposed. Potential visual impact for these receptors is expected to be **moderate**.

Protected areas likely to be visually affected include limited parts of the Thaba Manzi Game Farm, the Thyspunt National Heritage Site and State Forest below the plateau. Visual impacts are likely to be of low magnitude. Remaining impacts beyond the 20km radius are expected to be **very low** to **negligible**.

Kruisfontein, Humansdorp and surrounds are likely to experience **low** visual impact. Jeffrey's Bay and Sea Vista lie within this zone, and may experience very low visual impact in some outlying parts. The towns of Cape St Francis Kareedouw, Hankey and Weston will not be visually affected. Limited sections of the Lombardini Game Farm and Thyspunt National Heritage Site may be exposed to negligible visual impact.

» **Distribution power line**

There are three alternative alignments proposed for the new 132 kV overhead power line required to connect the proposed facility to Eskom's national grid. It is clear from Figure 6.6 map that the power line will be highly visible along all three alignment options. Areas of visual screening occur in areas of undulating topography and along incised river valleys. The following is of relevance:

* Option A is the shortest alignment, and therefore displays the smallest extent of potential visual exposure. Visual receptors include users of short stretches of the N2, R102 and R62 as well as a few settlements and homesteads.
* Option B is the second shortest alignment. Visual receptors include users of long stretches of the N2 and R102, short stretches of the R330 as well as a few settlements and homesteads. This alignment also crosses 3 rivers.
* Option C is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include users of short stretches of the N2, R102 and R330. This alignment also crosses 3 rivers.

It is clear from the above that options B and C will both result in significantly higher visual impact than option A. This is based both on the anticipated extent of visual exposure and the number of potential visual receptors likely to be visually exposed.

In order of preference, Option A is favoured from a visual perspective followed by Option C. Option B is considered the least favourable.

Note: Despite Option B being shorter than Option C, it is likely to result in a greater visual impact due to its long stretches of exposure along the N2. Option B is least favoured due to its greater exposure to potential visual receptors.

The potential cumulative impact of power lines along the N2 is also of relevance for Option B. An existing power line runs less than 3km north of

the N2 and Option B would result in the effective flanking of the N2 on both sides by power lines.

» **Lighting**

The receiving environment in close proximity to the proposed facility has a relatively small number of populated places (i.e. settlements / farmsteads) and it can be expected that the light trespass and glare from the security and after-hours operational lighting (flood lights) for the substation and other infrastructure will have some significance. Furthermore, the sense of place and rural ambiance of the local area increases its sensitivity to such lighting intrusions. It is also important that note be taken of the protected areas and potential eco-tourism destinations within close proximity to the proposed facility (i.e. the Kromrivierspoort National Heritage Site, Huisklip Nature Reserve, the Jumanji Game Farm and Klasies River Cave). Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

» **The potential to mitigate visual impacts**

The primary visual impact, namely the appearance of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The overall potential for mitigation is generally low or non-existent.

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an ongoing basis.

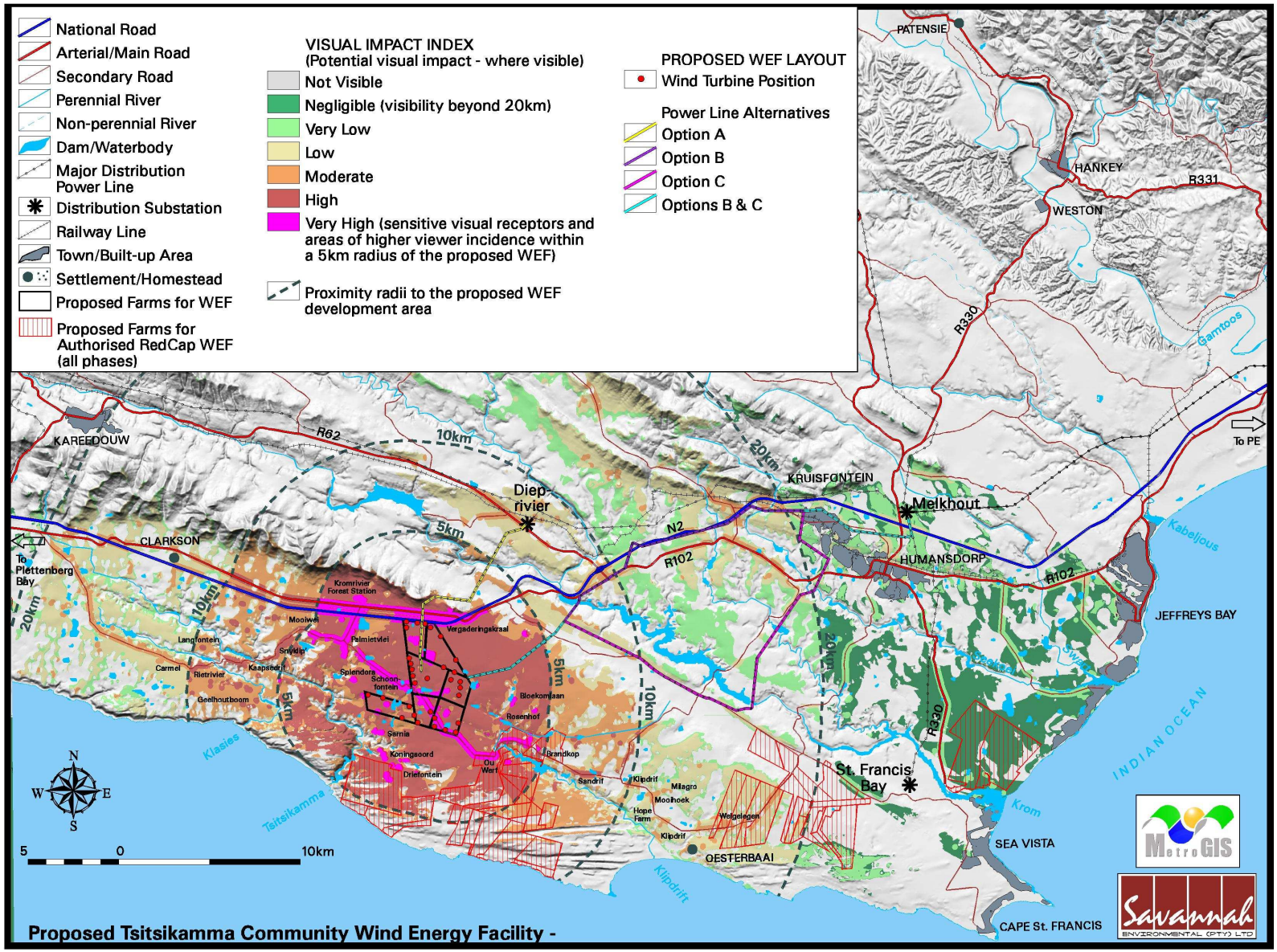

Figure 6.6: Visual impact index of the proposed wind energy facility

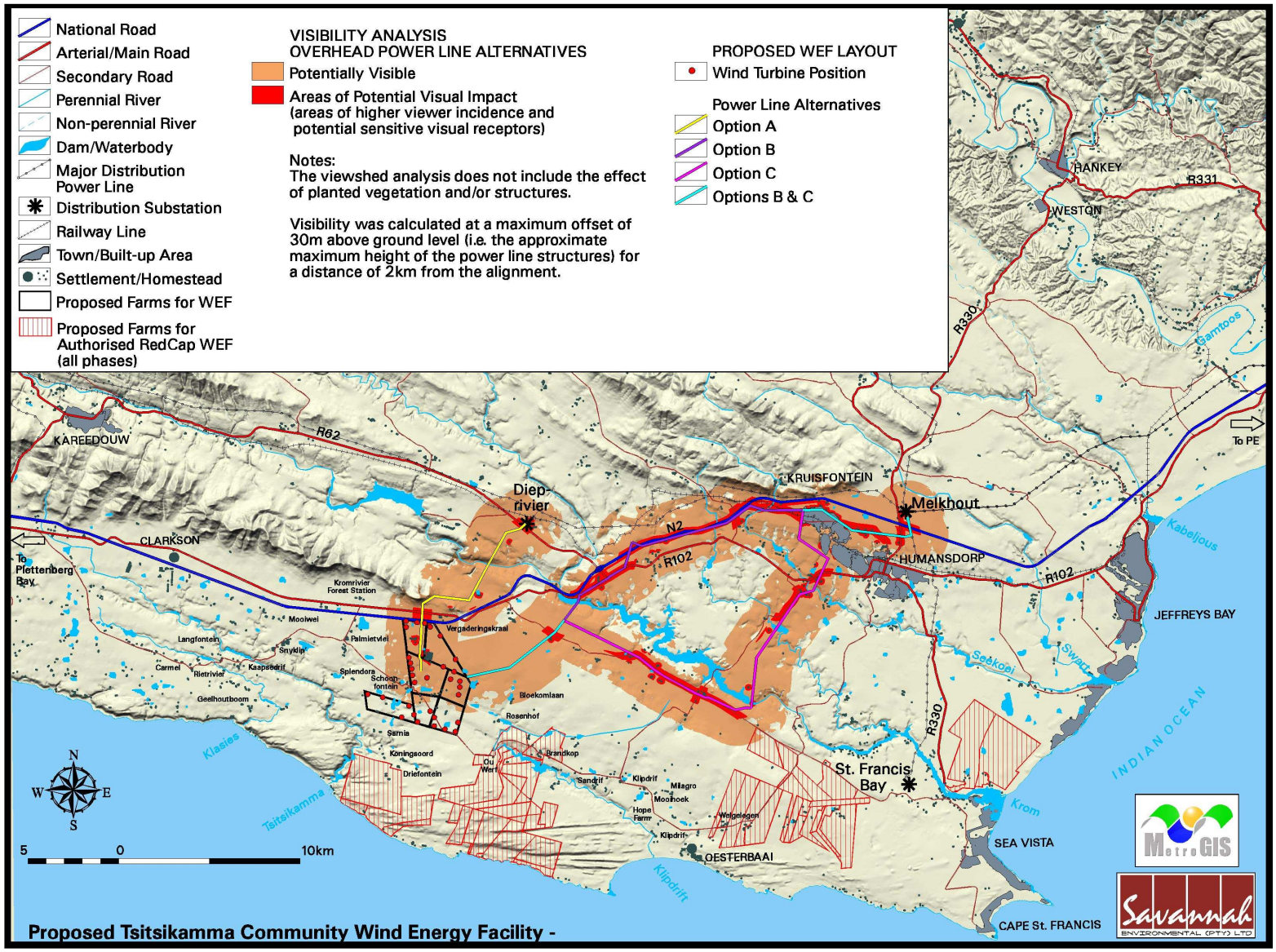

Figure 6.7: Visual impact index of the proposed power line routes

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

Nature of Impact: Potential visual impact on users of major and secondary roads in close proximity to the proposed facility Potential visual impact on users of national, arterial and secondary roads in close proximity of the proposed facility (i.e. within 10km) is expected to be high. No mitigation is possible.		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Very high (10)	N/A
Probability	Definite (5)	N/A
Significance	**High (90)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised RedCap Kouga Wind energy Facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Nature of Impact: Potential visual impact on residents of towns, settlements and homesteads in close proximity to the proposed facility The potential visual impact on residents of homesteads and settlements within a 10km radius of the proposed facility is expected to be high. No mitigation is possible.		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	Very high (10)	N/a
Probability	Definite (5)	N/a
Significance	**High (90)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during	No	N/a

operational phase?		
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised RedCap Kouga Wind energy Facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Nature of Impact: Potential visual impact on sensitive visual receptors within the region. The visual impact on the settlements and homesteads within the region (beyond the 10km radius) is expected to be of moderate significance. No mitigation is possible.		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	High (4)	N/A
Significance	**Moderate (52)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised RedCap Kouga Wind energy Facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Nature of Impact: Potential visual impact on protected areas in close proximity to the proposed Wind Energy Facility.

The potential visual impact on conservation/protected areas within a 10km radius of the proposed facility (i.e. the Kromrivierspoort National Heritage Site, Huisklip Nature Reserve, the Jumanji Game Farm, Klasies River Cave and State Forest) is expected to be of low significance.

As this study does not include any record of the nature or status of facilities present within these protected areas, or if indeed any facilities exist at all, the visual assessment assumes that visitor access is possible and permitted, and that the potential exists to develop tourist facilities and amenities of a private or public nature. The limited extent of visual exposure, however, reduces the probability of this impact occurring.

No mitigation is possible for this impact.

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High (8)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (16)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A

Mitigation:

Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years

Cumulative impacts:

The construction of 31 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised RedCap Kouga Wind energy Facility located to the south and south east of the site.

Residual impacts:

None. The visual impact of the wind turbines will be removed after decommissioning.

Nature of Impact: Potential visual impact on protected areas within the region

The potential visual impact on conservation/protected areas beyond the 10km radius of the proposed facility is expected to be of low significance. There is no mitigation this impact.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (1)	N/A

Significance	**Low (11)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised RedCap Kouga Wind energy Facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Nature of Impact: Potential visual impact of internal access roads on observers in close proximity to the proposed facility.

Within the facility footprint, existing roads will be used wherever possible. It may however be necessary to build additional roads either to construct each turbine (construction phase), or to maintain the turbines (operational phase).

The network of roads has the potential of manifesting as a network of landscape scarring, and thus a potential visual impact within the viewshed areas.

No dedicated viewshed has been generated for the access roads, but the area of potential visual exposure will lie within that of the turbines. They will not be as highly visible as the turbines, however, as they posses no height. This reduces the probability of this impact occurring.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (24)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No

Mitigation:

» Planning: Layout and construction of roads and infrastructure with due cognisance of the topography.
» Construction: rehabilitation.
» Decommissioning: ripping and rehabilitation of the road and servitude.

Cumulative impacts:

The construction of the roads will increase the cumulative visual impact within the region.

Residual impacts:

None. The visual impact of the wind turbines will be removed after decommissioning.

Nature of Impact: Potential visual impact of the substation and workshop areas on observers in close proximity to the proposed facility

The substation and workshop could present a visual impact. Areas of vegetation will need to be removed and industrial type structures will be built.

These structures have the potential of manifesting as industrial type development within an undeveloped environment.

No dedicated viewshed has been generated for the above infrastructure, but the area of potential visual exposure will lie within that of the turbines. This infrastructure is not likely to be as highly visible as the turbines, however, as the height will be much lower. This reduces the probability of this impact occurring.

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (24)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A

Mitigation:

Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years

Cumulative impacts:

The construction of the substation will increase the cumulative visual impact within the region.

Residual impacts:

None. The visual impact of the wind turbines will be removed after decommissioning.

Nature of Impact: Potential visual impact of the power line on observers in close proximity to the proposed facility.

The three alignment options have been indicated on Figure 6.7. This map also shows the potential visual exposure of all three power line options, calculated at a height of 30m above ground level, for a distance of 2km on either side of the alignment.

It is clear from this map that the power line will be highly visible along all three alignment options. Areas of visual screening occur in areas of undulating topography and along incised river valleys

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	High (4)	N/A
Significance	**Moderate (56)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A

Mitigation:

» Planning: selection of Alternative 1 for the power line alignment.
» Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years

Cumulative impacts:

The construction of the new power lines will increase the cumulative visual impact of power lines within the region.

Residual impacts:

The visual impact will be removed after decommissioning, if the power lines are also removed. If this is not the case, then the visual impact will remain.

Nature of Impact: Shadow flicker

Potential visual impact of shadow flicker on visual receptors in close proximity to the proposed facility. Shadow flicker occurs when the sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "most shadow impact is associated with 3-4 times the height of the object". Based on this research, a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**

Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: » Planning: ensure that all wind turbines are 500m or further from the nearest inhabited homestead of settlement. » Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: None.		
Residual impacts: None. The visual impact of shadow flicker will be removed after decommissioning and the removal of the wind turbines.		

Nature of Impact: Potential visual impact on of lighting at night on visual receptors in close proximity of the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Moderate (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: » Planning: pro-active lighting design and planning » Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines with their aircraft warning lights will increase the cumulative visual impact of such warning lights within the region. This is specifically relevant in light of the authorised RedCap Kouga facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the lighting will be removed after decommissioning.		

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed facility. During the construction period, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Low (4)
Probability	High (4)	Improbable (2)
Significance	**Moderate (44)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Construction: Proper planning, management and rehabilitation of the construction site		
Cumulative impacts: None.		
Residual impacts: None.		

Nature of Impact: Potential visual impact on the visual character and sense of place of the region. A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. Specific aspects contributing to the sense of place of this region include the pastoral visual quality of the farmland as well as the scenery beauty of the landscape and the mountains. The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be moderate. There is no mitigation for this impact.		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Probable (3)	N/A
Significance	**Moderate (39)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A

Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during operational phase?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact on the sense of place of the region. This is specifically in light of the authorised RedCap Kouga facility located to the south and south east of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Nature of Impact: Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourist potential within the region.

The study area has a pastoral character and is located within a particularly picturesque part of the country. The site also lies near to the south eastern seaboard of the country. Jeffrey's Bay, Sea Vista, Cape St Francis and Oyster Bay enjoy status as coastal holiday towns and tourist destinations.

The Eastern Cape also has 9 tourism routes of which the Kouga Route, encompassing Jeffrey's Bay, Cape St Francis and the Gamtoos River Valley, is of relevance within in the study area. In addition, the N2 is a well known and well used tourist access route, and many arterial and secondary roads make for scenic drives. Visual intrusion through the development of industrial type infrastructure within this environment could have a negative effect on the area's tourism value and potential.

The anticipated visual impact of the facility on existing tourist routes, coastal holiday towns and on the long term tourism potential of the region, is expected to be moderate. There is no mitigation for this impact.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Probable (3)	N/A
Significance	**Moderate (39)**	**N/A**
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable (3)	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated during	No	N/A

operational phase?		
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 31 wind turbines will increase the cumulative visual impact on the sense of place of the region. This is specifically in light of the authorised RedCap Kouga facility located to the south and south east of the site		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

» **Photo Simulations**

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the facility within the receiving environment. It indicates the visual significance of the alteration of the landscape from various sensitive visual receptors and over varying distances. The simulations are based on the wind turbine dimensions and layout as indicated in Figure 6.1. The purpose of the photo simulation exercise is to support the findings of the Visual Assessment, and is not an exercise to illustrate what the facility will look like from all directions.

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

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

Figure 6.8: Photosimulation from viewpoint located on the N1 bridge over a secondary road about 2,5km west of the site boundary.

The photo above (Figure 6.8) was taken from a position approximately 2.6km away from the closest turbine. Palmietvlei is visible in the medium distance. This view of a close range view that commuters travelling east along the N1 would have of the facility. This view may be considered similar to that observed from the R102, which lies less than 1km to the north.

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

6.7.2. Implications for Project Implementation

» It is envisaged that the wind turbine structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing at homesteads or visiting the region), especially within a 0km to 10 km radius (i.e. at short to medium distances) of the facility and would constitute a high visual prominence, potentially resulting in a high visual impact. Very limited parts of the Kromrivierspoort National Heritage Site the Huisklip Nature Reserve will be exposed to moderate visual impact, while the State Forest below the plateau falls within the zone of high visual impact.
» The primary visual impact is associated with the nature and extent of the wind turbines, and is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines,

once again aggravating the visual impact. The overall potential for mitigation is generally low or non-existent. Mitigation of secondary visual impacts associated with the construction of roads includes the use of existing roads wherever possible.

» Where new roads are required, these should be planned taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Access roads not required for the post-decommissioning use of the site should be ripped and rehabilitated during decommissioning.
» The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility (where this is possible). In this manner, less warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.
» Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of the construction site. Potential shadow flicker impacts should be mitigated by ensuring that all wind turbines are located 500 m or further from the nearest inhabited homestead of settlement.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated.

6.7.2. Conclusions and Recommendations

The facility would be visible within an area that is generally seen as having a high quality natural and pastoral landscape character. The N2 is a known tourist access route to the east coast and the scenic nature of the area and the proximity to coastal holiday towns lends the study area some tourism value. The potential to promote scenic drives and to tie in with the Kouga Tourism Route add to the potential of the area to develop in terms of tourism in the future. In addition, there is some conservation value of within the region. Although most of these are not proclaimed conservation areas, there will be some visual impact on these natural and undeveloped environments. The facility would thus visually impact on various sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive.

The following is a summary of impacts remaining, assuming mitigation as recommended is implemented:

- The potential visual impact of the facility on users of national, arterial and secondary roads in close proximity to the proposed facility will be of high significance.
- The anticipated visual impact on residents of settlements and homesteads in close proximity to the proposed facility will be of high significance.
- Within the greater region, the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of towns, settlements and homesteads) will be of moderate significance.
- Conservation / protected areas in close proximity to the proposed facility will experience visual impacts of low significance, as will those within the greater region.
- In terms of ancillary infrastructure, the anticipated visual impact of the substation and workshop will be of low significance, as will that of the internal access roads.
- Visual impacts of the proposed power line will be of moderate significance.
- Anticipated visual impacts related to lighting will be of moderate significance, while that of shadow flicker will be low.
- Similarly, the visual impact of construction is also expected to be of low significance.
- In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place of the region will be of moderate significance, as will the anticipated impact on tourist routes, tourist destinations and tourism potential.
- This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.
- Furthermore, it is the opinion of the author that this impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres such as Jeffrey's Bay, Sea Vista and Oyster Bay.

In order of preference, **Power Line Option A** is favoured from a visual perspective, while Option B is considered the least favourable.

6.8. Assessment of Potential Noise Impacts

Potential receptors in and around the proposed wind energy facility were identified and the status of the dwellings confirmed by a site visit (Refer to Noise study Appendix M).

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103. SANS 10103 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by

an intruding noise. Ambient (background) noise levels were measured during the day and night time in accordance with the South African National Standard SANS 10103:2003. From the data obtained, it can be seen that the ambient (background) sound levels are extremely low, ranging between 17 – 23 dBA during times when there is no wind, or very little air movement. As wind speeds increase, noise created by potential wind turbine generators approaches the wind induced noise levels.

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

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

- *Construction activities include the*
  - construction of access roads,
  - turbine tower foundations and electrical substation,
  - the possible establishment, operation and removal of concrete batching plants,
  - delivery of turbine, substation and power line components to the site,
  - digging of trenches to accommodate underground power cables; and
  - erecting of turbine towers and assembly of wind turbine generators.
- *Material supply for the facility*
- *Blasting on site*
- *Traffic movement*

- **Potential Noise Sources: Operational Phase**

  Noise emitted by wind turbines can be associated with two types of noise source. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment. These sources normally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substation, traffic movement as well as power line noise.

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

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

The following was considered in the Noise Impact Assessment:

» The octave band sound pressure emission levels of processes and equipment;
» The distance of the receiver from the noise sources;
» The impact of atmospheric absorption;
» The meteorological conditions in terms Pasquill stability;
» The operational details of the proposed project, such as the location of each wind turbine.
» Topographical layout (-3 dB penalty will be imposed due to the height of the wind turbine generators),
» Acoustical characteristics of the ground. Soft ground conditions were modelled, as the area where the facility is to be constructed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

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

» **Construction Phase Impacts**

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

- General work at the workshop area.
- Surface preparation prior to civil work.
- Preparation of foundation area.
- Pouring and compaction of foundation concrete (general noise, electric generator/compressor, concrete vibration, mobile concrete plant, TLB).
- Erecting of the wind turbine generator (general noise, electric generator/compressor and a crane).
- Traffic on the site

» **Operational phase impacts**

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

Typical daytime activities would include:

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

However, times when a quiet environment is desired (at night for sleeping, weekends etc.) noise levels are more critical. The time period investigated

therefore would be the quiet period, normally associated with the 22:00 – 06:00 slot. Maintenance activities would therefore not be considered, concentrating on the ambient sound levels created due to the operation of the various wind turbines at night.

There is a low risk that the projected ambient noise level could exceed the acceptable night time rating levels (when wind speeds are less than 6 m/s, else wind induced noise levels start to play a significant role).

Changes in ambient sound levels are projected to be low. Some receptors could experience noise levels that exceed the ambient sound level with more than 7 dBA during eastern winds and the noise from the facility would be considered to be "disturbing."

The operation of the wind turbines will slightly add to the acoustical energy in the low frequencies. However there is already significant acoustical energy in the low frequencies due to the wind induced noise. The risk of low-frequency noise impacting on noise sensitive developments is considered low.

The operation of the Tsitsikamma Wind Energy Facility would not cumulatively contribute to noise levels at the sensitive noise receptors of the Red Cap Kouga Wind Energy Facility. Neither will the Red Cap Kouga Wind Energy Facility significantly impact on the Tsitsikamma Wind Energy Facility in terms of cumulative noise impacts.

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

Nature: Noise associated with numerous simultaneous construction activities Acceptable Rating Level: rural district with little road traffic: 45 dBA outside during day.		
	Without mitigation	**With mitigation**
Extent	Regional – Change in ambient sound levels would extend further than 1,000 meters from activity (3)	Regional – Change in ambient sound levels would extend further than 1,000 meters from activity (3)
Duration	Long term – Noisy activities in the vicinity of the receptor could last up to a month (4)	Long term – Noisy activities in the vicinity of the receptor could last up to a month (4)
Magnitude	Low – Medium (2 – 6)	Low (2)
Probability	Impossible (1) - Possible (2)	Improbable (1)
Significance	**Low (9 – 26)**	**9 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of	N/A	N/A

resources?		
Can impacts be mitigated?	While mitigation is not required, the implementation of mitigation measures could result in a reduction of both the projected sound pressure levels and the probabilities that increased noises would impact on receptors.	

Mitigation:

Management options to reduce the noise impact during the construction phase include:

» Route construction traffic as far as practical possible from potentially sensitive receptors;

» Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include:

- Proposed working times;
- how long the activity is anticipated to take place;
- what is being done, or why the activity is taking place;
- contact details of a responsible person where any complaints can be lodged should there be an issue of concern.

» When working near (within 500 meters – potential construction of access roads and trenches) to a potential sensitive receptor(s), limit the number of simultaneous activities to the minimum; and

» When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. An example would be to work within the 08h00 to 14h00 time-slot to minimise the significance of the impact because potential receptors are most likely at school or at work, minimising the probability of an impact happening and normal daily activities will generate other noises that would most likely mask construction noises, minimizing the probability of an impact happening.

Technical solutions to reduce the noise impact during the construction phase include:

» Using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact.

» Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures.

Cumulative impacts:

This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area.

Residual impacts:

This impact will only disappear once construction activities cease.

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

Nature: Noise associated with numerous simultaneous operation activities

Acceptable Rating Level: rural district with little road traffic: 35 dBA outside during

nighttime.

	Without mitigation	**With mitigation**
Extent	Local – impact will extend less than 1,000 meters from activity (2)	Local – impact will extend less than 1,000 meters from activity (2)
Duration	Permanent – facility will operate for a number of years (5)	Permanent – facility will operate for a number of years (5)
Magnitude	Low (2) – medium (6) - Vestas V90 Wind Turbine Generator Low (2) – medium (8) - Vestas V112 Wind Turbine Generator	Low (2 - 4)
Probability	Improbable (1) - Likely (3)	Improbable (1) – Probable (2)
Significance	**39 (Moderate)** for NSD17 and NSD22 for the Vestas V90 Wind Turbine Generator **45 (Moderate)** for NSD17 and NSD22 for the Vestas V112 Wind Turbine Generator	**Low (22)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	N/A	N/A
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures that should be considered before the development of this wind energy facility would include:

» Ensuring a larger setback around the potentially sensitive receptors taking cognisance of prevailing wind directions. A setback of 750 meters around all Noise Sensitive Developments is proposed for the Vestas V90 2.0MW Wind Turbine Generator. It is highly recommended that turbines 18 and 15 be relocated further from the closest receptor.
» The developer can consider larger wind turbines which would require less wind turbines for the same power generation potential, but increase the buffer zone to than 950 meters (for the Vestas V90 3.0MW Wind Turbine Generator, the Vestas V112 3.0MW Wind Turbine Generator must be evaluated once noise emission data is available).
» Developing the same number of wind turbines over a larger area;
» A combination of the above options.

Mitigation measures that would reduce a potential noise impact after the implementation of the facility includes (should noise complaints be registered and verified):

» Operating all, or selected wind turbines in a different mode. The Vestas as well as most other manufacturers allow the turbines to be operated in a different mode. This allows the wind turbine generator to operate more silently, albeit with a slight reduction of electrical power generation capability. » Problematic wind turbines could also be disabled, or the rotational speeds significantly decreased during periods when a quieter environment is desired (and complaints registered). » A combination of the options proposed above.
Cumulative impacts: This impact is cumulative with existing ambient background noises.
Residual impacts: This impact will only disappear once the operation of the wind energy facility ceases.

6.8.1. Implications for Project Implementation

» Should the layout (or type of wind turbines used) change significantly, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist. This is critical should the developer select to use the larger V112 3.0MW wind turbine, as the data available to date is relatively preliminary.
» It is recommended that the ambient sound environment be defined over a longer period as per the environmental management plan.
» In addition quarterly monitoring noise monitoring should be conducted an acoustic consultant for the first year of operation. This monitoring is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured at a 10 meter height. These samples should be collected when the Wind Turbines are operational. Quarterly monitoring is recommended at two of the potential noise sensitive developments identified in the Noise Assessment for the first year (refer to Appendix M for the location of these receptors), as well as any other NSDs that have complained to the developer regarding noise originating from the facility.
» It is highly recommended that turbines 18 and 15 relocated further from the closest receptor such that a buffer of at least 750m is implemented between the turbine and the nearest sensitive receptor.
» Annual feedback regarding noise monitoring should be presented to all stakeholders and other Interested and Affected parties in the area. Noise monitoring must be continued as long as noise complaints are registered.
» Community involvement needs to continue throughout the project. A positive community attitude throughout the greater area should be fostered, particularly with those residents near the wind farm, to ensure they do not feel that advantage have been taken of them.

6.8.2. Conclusions and Recommendations

Wind turbines produce sound, primarily due to mechanical operations and aerodynamics effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources, and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that does impact areas at some distance away. When potential sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

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

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

The proposed power line routes are all acceptable in terms of potential noise impacts.

6.9. Assessment of Potential Social Impacts

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

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

» Potential positive impacts
- Creation of employment and business opportunities

» Potential negative impacts
- Impacts associated with the presence of construction workers employed on the project;
- Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site;
- Increased risk of veld fires associated with construction related activities;

- Impact of heavy vehicles, including damage to roads, safety, noise and dust;
- Loss of agricultural land associated with construction related activities.

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

» Potential positive impacts
- Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training
- The promotion of clean energy as an alternative energy source

» Potential negative impacts
- Impact of the proposed wind energy facility on the current farming activities
- The visual impacts and associated impact on sense of place
- Impact on tourism

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

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

Nature: Creation of employment and business opportunities during the construction phase Based on the information from other wind energy facilities, the capital expenditure associate with the construction of ~ 30 wind turbines during phase 1 would be in the region of R 1.5 billion. The construction phase is expected to extend over a period of 15-18 months and create approximately 200 temporary employment opportunities. The work associated with the construction phase will be undertaken by contractors and will include the establishment of the access roads and services and the erection of the wind turbines, substations and power lines. Of this total, ~ 20 % (40) of opportunities will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 30 (60) to semi-skilled personnel (drivers, equipment operators), and ~ 50 % (100) to low skilled personnel (construction labourers, security staff). In terms of the agreement between the proponent and the local community, represented by the Wittekleibosch Community Trust, the majority of the low skilled employment opportunities will accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in the area this will represent a significant social benefit. The majority of the semi and skilled employment opportunities are likely to be associated with the contactors appointed to construct the facility and associated infrastructure.

The proposed development will also create an opportunity to provide on-site training and increase skills levels. However, due to the relatively short timeframe of the construction phase and the low education and skills levels in the area, the opportunities for skills development and training of locals may be limited. However, the proponent has indicated that they are committed to implementing a training and skills development programme aimed at benefiting the local communities in the area. In this regard the proponent has taken 40 members from the local community on a capacity building trip to the Darling and Klipheuwel pilot facilities in the Western Cape Province. In addition the proponent has sponsored a Community Needs Analysis, hosted a number of training seminars and covered the costs for members from the community to attend the 2nd Annual Wind Energy Seminar in South Africa.

In addition to the employment benefits for members from the local Wittekliebosch community, the expenditure of R 1.5 billion during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and the high import content associated with wind turbines the opportunities for the local Kareedouw, Joubertina, Woodlands, Clarkson, Humansdorp, Jefferies Bay and Cape St Frances economy are likely to be limited. However, some of the required civil engineering and construction skills are likely to be available in the local area due to the recent boom in the housing sector (2000-2008). In addition a number of the required engineering and technical skills and expertise are likely to be available in the Nelson Mandela Metro which is located within 150 km of the site.

The sector of the local economy that is most likely to benefit from the proposed development is therefore the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. In terms of accessibility the majority of the construction workers from outside the area are likely to be accommodated in the closest town, which is Humansdorp. This will create potential opportunities for local hotels, restaurants and B&Bs. In addition, a proportion of the total wage bill earned by construction workers over the 15-18 month construction phase will be spent in the regional and local economy. Based on information from other wind energy facilities the total wage bill associated with the construction phase is estimated at R 15-20 million. The injection of income into the area in the form of rental for accommodation and wages will create opportunities for local businesses in Humansdorp, and to a lesser extent Kareedouw, Woodlands, and Clarkson. The benefits to the local economy will however be confined to the construction period (15-18 months).

The local hospitality industry in Humansdorp, and also Jefferies Bay and Cape St Frances, is also likely to benefit during the construction phase. These benefits are associated with accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc) and other personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to onsite construction workers but also to consultants and product representatives associated with the project.

	Without enhancement	**With enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local	Local – Regional (4)

	communities)	
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

Enhancement Measures:

» Employment

- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi- and low-skilled job categories. In this regard the proponent has entered into an agreement with the Wittekleibosch Community Trust, which falls under the Tsitsikamma Development Trust, to employ HD members from the local community where ever possible, specifically for low skilled jobs.
- Before the construction phase commences the proponent should meet with representatives from the Witteklieboschh Community Trust, Kou-Kamma and Kouga Municipality to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
- Representatives from the Witteklieboschh Community Trust and the Kou-Kamma and Kouga Municipality should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. In this regard the proponent has taken representatives from the Witteklieboschh community on a capacity building trip to the Western Cape Province to look at the Darling and Klipheuwel pilot wind energy facilities.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

» Business

- The proponent, in consultation with the Witteklieboschh Community Trust and the Kou-Kamma and Kouga Municipality, should develop a database of local companies, specifically companies that qualify as Black Economic Empowerment (BEE) companies, that qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work.
- Where possible, the proponent, in consultation with the Witteklieboschh Community Trust and the Kou-Kamma and Kouga Municipality, should assist local BEE

companies to complete and submit the required tender forms and associated information.

* The representatives from the Witteklieboschh Community Trust, Kou-Kamma, Kouga Municipality, local Chamber of Commerce and local hospitality industry should identify strategies aimed at maximising the potential benefits associated with the project.

Cumulative impacts:

Opportunity to up-grade and improve skills levels in the area.

Residual impacts:

Improved pool of skills and experience in the local area.

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

Based on the findings of the SIA the area can be described as a rural area that is "safe and secure". In terms of affected farmsteads, there are a relatively small number of farmsteads that will be affected by the proposed project. However, there are a number of potentially vulnerable farming activities, specifically and cattle and dairy farming. The potential threat to farming activities is discussed below. In addition, the presence of construction workers also poses a potential risk to family structures and social networks in the area (both on farms and in the local towns of Humansdorp). While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard, the most significant negative impact is associated with the disruption of existing family structures and social networks.

Comments from people interviewed indicated that there were concerns about the influx of employment seekers into the area due to the rumours regarding the proposed construction of the ESKOM nuclear power station at Oyster Bay. The area is therefore already experiencing an influx of employment seekers. However, the potential risk posed by the influx of construction workers associated with the proposed Tsitsikamma Wind Energy Facility to local family structures and social networks is likely to be low. This finding is based on the relatively small number of semi and low skilled construction workers associated with the construction phase, namely 160. In addition, the potential impact will be reduced as the majority of low skilled workers will be sourced from the local community, specifically the Wittekleibosch community area, including the settlements of Woodlands and Clarkson. These workers come from and live in the local community and as such form part of the local family and social network. As a result the potential impacts will be low.

	Without mitigation	**With mitigation**
Extent	Local (2) (Rated as 2 due to potential severity of impact on local communities)	Local (1) (Rated as 1 due to potential severity of impact on local communities)
Duration	Short term for community as a whole (1) Long term-permanent for	Short term for community as a whole (1) Long term-permanent for

	individuals who may be affected by STDs etc. (5)	individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)** for the community as a whole **Moderate-High (51)** for specific individuals who may be affected by STDs etc.	**Low (18)** for the community as a whole **Moderate-High (48)** for specific individuals who may be affected by STDs etc.
Status (positive or negative)	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on subsistence farming for their livelihoods	
Can impacts be mitigated?	Yes, to some degree. However, the risk cannot be eliminated.	

Mitigation Measures:

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks. In this regard the proponent has entered into an agreement with the Witteklieboscb Community Trust, which falls under the Tsitsikamma Development Trust, to employ HD members from the local community where ever possible, specifically for low skilled jobs.

» The proponent should consider the establishment of a Monitoring Forum for the construction phase. The Forum should be established before the construction phase commences and include representatives from the Witteklieboscb Community Trust, local councillors, farmers and the contractor. The role of the Forum would be to monitor the construction phase and the implementation of the recommended mitigation measures. The forum should also be briefed on the potential risks to the local community associated with construction workers.

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

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

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

basis.

» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 15-18 month construction phase. This would reduce the risk posed by construction workers from outside the area on local family structures and social networks.

» It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Cumulative impacts

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

Residual impacts

See cumulative impacts.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site

Phase 1 of the project involves the establishment of ~ 30 turbines on community land and as such will not impact on privately owned farms in the area. However, the presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may also be damaged. Stock and game losses may also result from gates being left open and/or fences being damaged. However, the majority of farm owners interviewed (Messrs Anderson, Biggs, Varmaak, Cilliers) indicted that they did not believe that the proposed development would impact on their farming operations. Mr Strydom indicated that did not have sufficient information on the proposed development to comment. While the potential issue of stock theft was not raised as a concern, it is an issue that should be noted. The potential impacts can, however, be effectively managed and mitigated.

Comments from the local farmers interviewed indicated that they have no formal agreement with the proponent with regard to compensation for damages to farm property and disruptions to farming activities. The proponent has however indicated that such an agreement will be drafted for Phase 2 of the project, which will entail the establishment of wind turbines on private farm land.

	Without mitigation	**With mitigation**
Extent	Local (3) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)

Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc	Yes, compensation paid for stock losses etc
Irreplaceable loss of resources?	No.	
Can impacts be mitigated?	Yes however some loss of farmland cannot be avoided.	

Mitigation Measures:

» The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.

» The proponent should consider the option of establishing a monitoring forum that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site.

» The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below).

» The EMP must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

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

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

» The housing of construction workers on the site should be limited to security personnel.

Cumulative impacts

No, provided losses are compensated for.

Residual impacts

No, provided losses are compensated for.

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

The presence of construction workers and construction-related activities on the site poses

an increased risk of veld fires that in turn pose a threat to the livestock, wildlife and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened.

	Without mitigation	**With mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate due to reliance on agriculture for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc	Yes, compensation paid for stock losses etc
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation Measures:

» The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.

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

» The contractor must ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months.

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

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

» As per the conditions of the Code of Good Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

Cumulative impacts:

None, provided losses are compensated for.

Residual impacts:

None, provided losses are compensated for.

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

Road access to the proposed facility is likely to be via the Palmieitvlei Road that accesses onto the N2 National Road. The movement of heavy construction vehicles during the construction phase has the potential to damage roads and create noise, dust and safety impacts for other road users. The movement of large, heavy vehicles also has the potential to create delays for other road users, specifically local famers and dairy tankers. Delays to dairy tankers may have economic implications for both the affected farmers and the owners of the dairy tankers.

Based on information from similar facilities approximately 5 abnormal heavy load trips are associated with the transport of a single turbine onto site. These include loads associated with 40-55 m rigid turbine blades, as well as abnormally heavy loads associated with the 80-ton nacelles. The total number of trips associated with the proposed establishment of 50 turbines would therefore be in the region of 250 trips. In addition, a crawler crane (~ 750 t) and assembly cranes will also need to be transported onto and off the site. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc.

Based on the observations during the field visit (July 2011) the existing Palmieitvlei Road will need to be upgraded to enable the site to be accessed. Following the heavy rains in July 2011, the Palmieitvlei Road was also in a poor condition. This condition was exacerbated by the movement of heavy dairy tankers along the road (See Photograph 2.5). However, the typical issues associated with the movement of heavy vehicle traffic during the construction phase can be effectively mitigated. These issues are therefore not regarded as significant concerns.

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

Mitigation Measures:

» The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the

construction phase. The costs associated with the repair must be borne by the proponent.

» The proponent and contactor should meet with the local farmers to identify the best time of the day to transport heavy machinery on to the site so as to minimise potential disturbances to other road users.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts: :

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

Residual impacts:

Refer to cumulative impacts.

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines, substation and power line will damage farmlands and result in a loss of farmlands for future farming activities.

The significance of the impact is to some extent mitigated by the fact that the farming activities in the area are confined to stock farming as opposed to crops. In addition, the experience with wind energy facility developments elsewhere is that livestock farming is not significantly affected by wind energy facilities. Where properly planned, the final footprint of disturbance associated with a wind energy facility is also small and is linked to the foundation of the individual wind turbines, services roads, substations and power lines. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not rehabilitated (5)	Short term if damaged areas are rehabilitated (1)
Magnitude	Moderate, due to importance of farming in terms of local livelihoods (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (60)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes, in the long term if facility is dismantled and area is rehabilitated	

Irreplaceable loss of resources?	No, disturbed areas can be rehabilitated	No, disturbed areas can be rehabilitated
Can impacts be mitigated?	Yes, however, loss of farmland cannot be avoided during operational phase	

Mitigation Measures:

» The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. This should include includes damage to and loss of farm land. The agreement should be signed before the construction phase commences. In this regard the proponent has entered into an agreement with the Witteklieboscb Community Trust, which falls under the Tsitsikamma Development Trust, to address these issues. Similar agreements need to be entered into with the private farm owners in the area when Phase 2 is planned.

» The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop etc.) should be minimised.

» An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.

» All areas disturbed by construction related activities, such as access roads, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.

» The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed to establish the facility. The specifications for the rehabilitation programme should be drawn up the botanical specialist appointed as part of the EIA process.

» The implementation of the Rehabilitation Programme should be monitored by the ECO;

» The proponent should compensate farmers that suffer a permanent loss of land due to the establishment of the facility. Compensation should be based on accepted land values for the area.

Cumulative impacts:

Overall loss of farmland may impact on the livelihoods of the affected farmers, their families and the workers on the farms and their families. However, due to the small scale of the proposed development, there will be no significant cumulative impacts and disturbed areas can also be rehabilitated.

Residual impacts:

Refer to cumulative impacts.

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

Nature: Creation of employment and business opportunities associated with the Operation phase

Based on information provided by the proponent Energy approximately 10-15 permanent staff (administrative, management, monitoring, maintenance and security) will be employed during the operational lifespan of the Tsitsikamma Wind Energy facility (20-25 years). The wage bill associated with the operational phase is estimated at R4 million per year (current value).

Due to the need for specialised skills it may be necessary to import the required operational and maintenance skills from other parts of South Africa or even overseas. However, it will be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the Kou-Kamma and Kouga IDPs. In this regard the proponent has entered into an agreement with the Witteklieboscb Community Trust, which falls under the Tsitsikamma Development Trust, to implement a training and skills development programme for HD members from the local community.

Given the location of the proposed facility the majority of permanent staff is likely to reside Humansdorp. Some permanent staff may also elect to live at the coast, in towns such Jeffery's Bay and Cape St Frances. In terms of accommodation options, a percentage of the new permanent employees may purchase houses in one of these towns, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the annual wage bill earned by permanent staff would be spent in the regional and local economy. This will benefit local businesses in the local towns in the area. The benefits to the local economy will extend over the 25-year operational lifespan of the project. The local hospitality industry is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc) who are involved in the company and the project but who are not linked to the day-to-day operations.

Research undertaken by Warren and Birnie (2009) also highlights the importance of addressing community benefits in the development and implementation of wind energy facilities. The findings of the research found that wind farms in Europe became more socially acceptable when local communities were directly involved in, and benefited from the developments. In Denmark, Germany, the Netherlands and Sweden, where wind farms have typically been funded and controlled by local cooperatives, there has been widespread support for wind power. However, in Britain where the favored development approach has been the private developer/public subsidy model, many proposals have faced stiff local opposition. This is an issue that should be addressed in the South African context.

In this regard, the Tsitsikamma Wind Energy Facility represents a collaborative partnership between the proponent and the local HD community represented by the Witteklieboscb Community Trust, which falls under the Tsitsikamma Development Trust. In terms of the agreement the Tsitsikamma Development Trust have a 26% share in the project and Exxaro (the proponent) hold the remaining 74% share. The proponent has indicated that due to the competitive nature of the bidding process for renewable energy applications the proponent was not in a position to make sensitive financial information available at this stage in the process.

	Without enhancement	**With enhancement**
Extent	Local and Regional (2)	Local (4) (Rated as 4 due to benefit to local Witteklieboscb community memebers)

Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (30)**	**High (70)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be enhanced?	Limited opportunity due to small scale of project	

Enhancement Measures:

» The proponent has entered into an agreement with the Witteklibosch Community Trust, which falls under the Tsitsikamma Development Trust. This is regarded as an appropriate enhancement measure.

» In addition the proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project.

Cumulative impacts:

Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area

Residual impacts:

See cumulative impacts.

Nature: Promotion of clean, renewable energy

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producer of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively small. However, the ~ 60 MW generated during Phase 1 will contribute towards offsetting the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as significant.

	Without enhancement	**With enhancement**
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Very High (10)

Probability	Highly Probable (4)	Highly Probable (4)
Significance	**High (64)**	**High (72)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impacts be enhanced?	Yes	
Enhancement Measures: » None		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: See cumulative impacts.		

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

This issue relates to the potential long-term impact of the facility on existing farming activities, specifically the loss of grazing available for cattle and other livestock. As indicated above, Phase 1 of the project involves the establishment of ~ 30 turbines on community land and as such will not impact on privately owned farms in the area. However, the activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines, substations and power lines will damage communal farmlands and result in a loss of farmland for future farming activities. During Phase 2 these impacts will affect private farm owners. In this regard one of the local farmers, Mr Ferreira, indicated that he had a small farm and that the loss of land would impact on his operations.

However, the significance of the impacts is mitigated by the fact that the farming activities in the area are confined to stock farming as opposed to crops. The experience with wind energy is that livestock farming is not affected by operational facility. The final footprint of isturbance associated with wind energy facilities also tends to be small and is linked to the foundation of the individual wind turbines, services roads, sub-stations and power lines. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status (positive or	Negative	Neutral

negative)		
Reversibility	Yes. Land that is lost to footprint associated with wind energy facility (roads, turbines etc) can be restored to farm land over time if rehabilitated.	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation Measures: » The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop, etc) should be minimised. » An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase. » It is assumed that the proponent has entered into an agreement with the affected landowners whereby the company will compensate for damages which includes loss of productive farmland. » The implementation of the Rehabilitation Programme should be monitored by the ECO.		
Cumulative impacts: Potential minor loss of agricultural employment opportunities associated with loss of land.		
Residual impacts: See cumulative impacts.		

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

The turbines associated with the proposed facility will have a visual impact and, in so doing, impact on the rural sense of the place of the area and the landscape. While none of the local farmers interviewed identified visual impacts as a significant concern, this does not imply that the proposed facility will not impact on the area's sense of place and the landscape. Experience from elsewhere, such as Australia and Scotland, indicates that impacts on the landscape represents one of the most significant concerns associated with wind farms. The potential for mitigating the impact on the area's sense of place and the landscape is low.

	Without mitigation	**With mitigation**
Extent	Local (3) (Reflects impact on local residents and travellers along N2 and other key access roads in the area)	Local (3) (Reflects impact on local residents and travellers along N2 and other key access roads in the area)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (52)**	**Medium (52)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes. Wind turbines can be removed.	
Irreplaceable loss of	No	

resources?	
Can impacts be mitigated?	Yes
Mitigation Measures: » The recommendations contained in the Visual Impact Assessment should be implemented.	
Cumulative impacts: Potential impact on current rural sense of place. However, due to small scale of facility proposed the impact would be limited.	
Residual impacts: See cumulative impacts.	

Nature: Potential impact of the wind energy facility on local tourism

The potential impacts on tourism are closely related to potential visual impacts associated with the proposed facility. In this regard the Tsitsikamma site is visible from the N2, which is an important tourist route. As indicated above, the R62, which is located to the north-east of the site, is also an important tourist route and a designated scenic route. As indicated above the findings of the VIA indicate that the region has a rural character and is located within a particularly picturesque part of the country. It is in close proximity to the southern seaboard, and is thus a known tourist destination. In addition, the N2 is a well-known and well used tourist access route, and the arterial and secondary roads make for scenic drives. The anticipated visual impact of the facility on existing tourist routes, as well as on the tourism potential of the region, is expected to be moderate. There is no mitigation for this impact. However, an advantage of the site over other sites in the area, is that the proposed site is not located on prominent ridgelines or hills.

However, research in Scotland undertaken by Warren and Birnie (2009) found that there appeared to be no clear evidence that tourists would be put off by the presence of wind farms in tourism areas. In this regard far more visitors appeared to associate wind farms with clean energy than with landscape damage, suggesting that they could help to promote an area's reputation as an environmentally friendly area, provided they are sensitively sited. However, the paper notes that this could change as more are built. The key lesson for South Africa is this regard is that wind farms should be located in areas that minimise the potential impact on landscapes and as such also reduce the potential impact on tourism.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	

Can impacts be mitigated?	Yes

Mitigation Measures:

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

Cumulative impacts:

Impact on sense of place.

Residual impacts:

See cumulative impacts.

Nature: Cumulative impacts on sense of place and the landscape

The cumulative impacts associated with the proposed wind energy facilities from a social perspective relate largely to the impact on sense of place and visual impacts. The area designated for the proposed projects is rural and agricultural in nature. The dominant current land use activity in the area is livestock farming. The proposed wind energy facilities will dramatically alter the sense of place and the existing landscape which will be dominated by turbines. In this regard, a number of local residents in the area have raised concerns regarding the cumulative impacts associated with the establishment of wind energy facilities in the Humansdorp, Jefferies Bay and Cape St Frances area. These residents are not opposed to wind energy per se, however, concerns were raised regarding the number of proposed wind energy facilities being mooted in the area.

In terms of visibility to passing motorists, the N2 is an important tourist route. The issue of Sequential Visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail) is therefore a concern. The potential cumulative impacts are also highlighted by the findings of the VIA (MetroGIS, August 2011).

The visual and cumulative impacts on landscape character are highlighted in the research undertaken by Warren and Birnie (2009). The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and diametrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries. The paper also identifies two factors that important in shaping people's perceptions of wind farms' landscape impacts. The first of these is the cumulative impact of increasing numbers of wind farms (Campbell, 2008). The research found that if people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. This relates to people's perception and relationship with the landscape. In the South African context, the majority of South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape. The impact of wind energy facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of wind farm applications.

The cumulative impact associated with the proposed Tsitsikamma Wind Energy Facility will

however to some extent mitigated by the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.		
	Without mitigation	**With mitigation**
Extent	Local and regional (4)	Local and regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (55)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation Measures: » The establishment of more than one large wind energy facility in the area is likely to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of wind energy facilities in the area, and the associated number of wind turbines. In addition, the siting of individual turbines on each of the wind energy facility sites should be informed by findings of the VIA, specifically with respect to visual impact on roads frequently used by tourists.		
Cumulative impacts: Impact on other activities whose existence is linked to rural sense of place and character of the area.		
Residual impacts: N/A/		

6.9.1. Implications for Project Implementation

» The findings of the Social Assessment indicate that the proposed development will create employment and business opportunities for locals during both the construction and operational phase of the project. However, these benefits will be limited. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented.
» The proposed development represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The cumulative impacts associated with multiple proposed wind energy facilities in the area on the sense of place and landscape cannot be ignored. The cumulative impact of wind energy facilities on the rural landscapes is an

issue that will need to be addressed by the relevant environmental authorities, specifically given the large number of applications for wind energy projects that have been submitted over the last 12 months.

6.9.2. Conclusions and Recommendations

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

The findings of the Social Impact Assessment support the findings of the Visual Impact Assessment and indicate that **Power Line Option A** is favoured from a visual perspective, while option B is considered the least favourable. There are no significant social impacts associated with the on-site substation.

6.10. Summary of All Impacts

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

Nature	Without mitigation	With mitigation
Potential impacts on vegetation and ecology (turbines)		
Impact on threatened bat species	Moderate	Low
Impacts on threatened animal species	Low	Low
Impacts on threatened plant species	Low	Low
Damage to wetlands	Low	Low
Establishment and spread of declared weeds and alien invader plants	Low (negative)	Moderate (positive)
Potential impacts on vegetation and ecology (power line)		
Impact on threatened bat species	Low	Low
Impacts on threatened animal species	Low	Low
Impacts on threatened plant species	Moderate	Low
Damage to protected trees	Moderate	Low
Impacts on indigenous vegetation	Moderate	Low
Establishment and spread of declared	Moderate	Low

Nature	Without mitigation	With mitigation
weeds and alien invader plants		
Damage to wetlands	Moderate	Low
Potential impacts on vegetation and ecology (access roads and cabling)		
Impact on threatened bat species	Low	Low
Impacts on threatened animal species	Low	Low
Impacts on threatened plant species	Low	Low
Loss of indigenous natural vegetation	Low	Low
Damage to wetlands	Moderate	Low
Establishment and spread of declared weeds and alien invader plants	Low (negative)	Moderate (positive)
Potential impacts on avifauna		
Disturbance during the construction and operational phases	Moderate	Moderate
Habitat loss - destruction of habitat for priority species, either temporary – resulting construction activities peripheral to the built area, or permanent - the area occupied by the completed development	Moderate	Low - Moderate
Mortality - Collision of priority species with the wind turbine blades and/or any new power lines, or electrocution	Moderate	Moderate
Potential impacts on geology, soil, and erosion potential		
Removal and displacement of soil for roads, pipelines and structures.	Moderate	Low
Soil degradation - loosening, mixing, wetting, and compacting of in situ soil during earthworks, affecting soil formation processes, hydrology, and ecosystems	Moderate	Low
Increased pollution of soil by contaminants	Low	Low
Soil degradation by wind & water	Moderate	Low
Reduction in soil erosion by water as a result of improved drainage and control of run-off (positive)	Moderate	N/A
Siltation of waterways and dams downstream from site, affecting ecosystems and hydrology	Low	Low
Dust pollution from construction site affecting areas surrounding site	Low	Low
Impacts on Agricultural Potential		
Loss of agricultural potential and land capability owing to the development	Low	Low
Potential impacts on heritage sites		

Nature	Without mitigation	With mitigation
Impacts to the pre-colonial archaeology	Low	Low
Impacts to the pre-colonial cultural landscape	Moderate	Low
Potential impacts on palaeontology		
Disturbance or destruction of valuable fossil heritage	Moderate	Low
Potential visual impacts		
On users of major roads and secondary roads in close proximity to the proposed facility	High	N/A
On residents of settlements and homesteads in close proximity to the proposed facility	High	N/A
On sensitive visual receptors (users of roads and residents of towns, settlements and homesteads) within the region	Moderate	N/A
On protected areas in close proximity to the proposed facility	Low	N/A
On protected areas in the region	Low	N/A
Potential visual impact of internal access roads on observers in close proximity to the proposed facility.	Low	Low
Potential visual impact of the substation and workshop areas on observers in close proximity to the proposed facility	Low	N/A
Potential visual impact of the power line on observers in close proximity to the proposed power line	Moderate	N/A
Potential visual impact of lighting on visual receptors in close proximity of the proposed facility	Moderate	Moderate
Potential visual impact of shadow flicker on visual receptors in close proximity of the proposed facility	Low	Low
Potential visual impact of construction on visual receptors in close proximity of the proposed facility	Moderate	Low
Potential visual impacts on the visual character and sense of place of the region	Moderate	N/A
Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourism potential within the region	Moderate	N/A

Nature	Without mitigation	With mitigation
Potential noise impacts		
Numerous simultaneous construction activities that could affect potential sensitive receptors.	Low	Low
Numerous turbines operating simultaneously during a period when a quiet environment is desirable.	Moderate	Low
Potential social impacts		
Creation of employment and business opportunities associated with the construction phase (Positive Impact)	Moderate	Moderate
Potential impacts on family structures and social networks associated with the presence of construction workers	Low (Negative impact for community as a whole) Medium-High (Negative impact of individuals)	Low (Negative impact for community as a whole) Medium-High (Negative impact of individuals)
Potential loss of livestock, poaching and damage to farm infrastructure	Moderate	Low
Risk of grass fires	Moderate	Low
Assessment of impact as a result of construction vehicles	Low	Low
Assessment of impact on farmland due to construction related activities	High	Low
Creation of employment and business opportunities associated with the operational phase (Positive Impact)	Moderate	High
Development of infrastructure to generate clean, renewable energy (Positive Impact)	High	High
Visual impact associated with the proposed wind turbines and the potential impact on the areas rural sense of place	Moderate	Moderate
Loss of productive agricultural land due to the establishment of a wind energy facility and the impact on farmers livelihoods	Moderate	Moderate
Impact on tourism	Moderate	Moderate
Cumulative impacts on sense of place and the landscape associated with multiple wind energy facilities in the area	High	Moderate

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

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

6.10. Comparative Assessment of Layout Options

Three **alternative corridors** are proposed for the proposed power line (refer to Figure 6.6):

One option for connecting to Eskom's existing Diep Rivier Substation

» **Option A**: Option A exits the site on its northern boundary and runs north, crossing over the N2 and the R102. Thereafter it turns to the east to connect with the national grid at the Diep Rivier Distribution Substation. The length of this option is 11,91km.

Two options to connect to Eskom's existing Melkhout Substation (in the event that connection to Eskom's existing Diep Rivier Substation is not feasible)

» **Option B:** Option B exits the site on its north eastern boundary and runs to the north east until it reaches the N2. It follows the alignment of the N2 for some distance, turning to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 29,76km.
» **Option C:** Option C exits the site on its north eastern boundary and runs to the north east for about 5km before turning to the south east. Some 10km further on, the alignment bends back to the north east before it turns sharply to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 38,59km.

No other layout alternatives were assessed as part of the EIA as discussed in Section 2.1 of this EIA report.

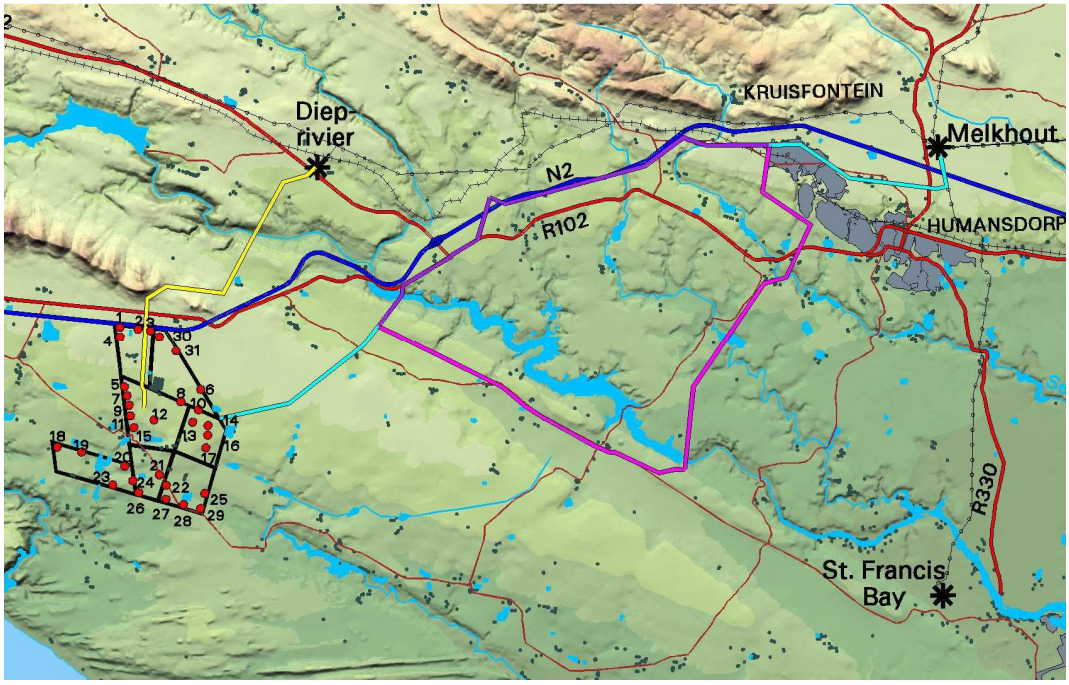

Figure 6.6: Close up view of power line alternative routes assessed in the EIA report (Option A: yellow line, Option B: purple line, Option C: pink line)

Option A to Diep Rivier Substation is preferred overall due to its comparatively shorter length. This is supported by the visual, avifauna, heritage and social assessments.

In the event of connection to Melkhout Substation is indicated as the most technically feasible option, **Option C** is considered the most preferred option for connection to the existing Melkhout Substation. This is supported from an ecological, visual and social perspective.

Both **Option A** and **Option C** are considered acceptable from an environmental perspective. The recommendation is that **both Option A and Option C** should be included within the environmental authorization to make allowance for connection to both the Diep Rivier substation and the Melkhout Substation (in the event that connection to Diep Rivier Substation is not possible). Connection to Diep Rivier Substation is preferred due to its shorter length which will decrease potential visual and associated social / cultural impacts on sense of place.

Option B is not preferred due to its greater potential for visual impacts.

6.11. Assessment of Potential Cumulative Impacts

Cumulative impacts, in relation to an activity, refer to the impact of an activity that in-itself may not be significant but may become significant when added to

the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area. The cumulative impacts associated with the proposed wind energy facility can be viewed from two perspectives: 1) cumulative impacts associated with the scale of the project, i.e. that up to 31 turbines will be located on one site; and 2) cumulative impacts associated with other activities/developments in the area.

The potential *direct* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» Visual impact on the surrounding area at a local level on the landscape and the areas rural sense of place and character. This impact will be exacerbated by the sequential visibility (e.g. the effect of seeing two or more wind energy facilities along a single journey, e.g. road or walking trail) of the sites, specifically for motorists travelling along the N2, which is an important tourist route that links Cape Town with the Eastern Cape.

  The cumulative impact associated with the proposed Tsitsikamma Wind Energy Facility will however to some extent mitigated by the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.

  Based on the information available at the time of undertaking the EIA, it would appear that at least five other wind energy facilities are proposed in the region, all within ~ 20 km of the proposed Tsitsikamma Wind energy Facility site. These include the authorised RedCape Kouga Wind Energy Facility, the authorised Deep River Wind Energy Facility, the proposed Happy Valley Wind Energy Facility, the proposed Jeffrey's Bay Wind Energy Facility and the proposed Oyster Bay Wind Energy Facility.

The potential *indirect* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» *Flora, fauna, avifauna and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of birds and bats may become cumulative if other wind energy facilities are developed in the region. Collision rates may appear relatively low in many instances, however cumulative effects over time, especially when applied to large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable conservation significance. Furthermore, when viewed in isolation, one wind energy facility may pose only a limited threat to the

avifauna of the region. However, in combination they may result in the formation of significant barriers to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become repeated arrays of turbines spread across foraging areas and/or flight paths of priority species.

» *Cumulative geology, soil and erosion potential impacts* - although the impact of soil removal for the proposed activity has a low - moderate significance, the cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate due to the severely degraded by mining operations to the south of the study area. The cumulative impact of siltation and dust in the area is considered low.

» *Cumulative noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. The potential for cumulative impacts is low.

» *Cumulative impacts on soils and agricultural potential* - the cumulative impact of this activity on agricultural potential will be small if managed but can have widespread impacts if ignored.

» Increased pressure on roads and other infrastructure.

Cumulative effects have been considered within the detailed specialist studies, where applicable (refer to Appendices F - N) and are listed in the tables in the sections above.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 7

The proposed Tsitsikamma Community Wind Energy Facility site is situated approximately 30 km west of Humansdorp, south of the N2 National Road in the Tsitsikamma area. Based on an extensive pre-feasibility analysis and site identification process undertaken, as well as an analysis of the wind resource in the area, a favourable area has been identified for consideration and assessment as per the requirements of an Environmental Impact Assessment (EIA). The site being considered for the proposed wind energy facility covers an area of approximately 54 km^2 which has primarily been used for agricultural activities. This site is proposed to accommodate wind turbines with a generating capacity of up to 100 MW as well as the associated infrastructure which is required for such a facility (i.e. substation, access roads and distribution power line linking to Eskom's existing Melkhout substation).

Infrastructure associated with the facility will include:

» **31 Wind Turbines** (with a hub height of up to 100m) with a total generating capacity of ~100 MW
» **Foundations** (of up to 15 x 15 x 3 m) to support the turbine towers
» Underground cables between turbines
» A **substation** (covering an area of up to 25m x 25m) within the development site
» An overhead **power line** (i.e. 132 kV distribution line) which will link to the existing Eskom Diep Rivier Substation ~8 km north of the site; or alternatively the Melkhout Substation ~ 25 km northeast of the proposed site
» Internal **access roads** (of up to 6m wide) to each wind turbine.
» **Main access road / haul road** to the site
» Workshop / administration building

The Wind Energy Facility is proposed on the following farms: Portions 19 and 22 of Zalverige Valley 660, Portions 3 and 5 of Vergaaderingskraal 675, Portion 1 of Ou Driefontein 721, Portion 2 of New Driefontein 720, Portions 3 - 9 of Wittekleibosch 787, Farm 818, Remainder of Farm 678 and Portion 3 of Kliprug 676.

The environmental impact assessment (EIA) for the proposed Tsitsikamma Community Wind Energy Facility has been undertaken in accordance with the EIA Regulations of GN R543 (Regulations 26-35) and R545, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The EIA Phase aimed to achieve the following:

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

7.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - N provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Draft EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility; including the alternative power line corridors. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

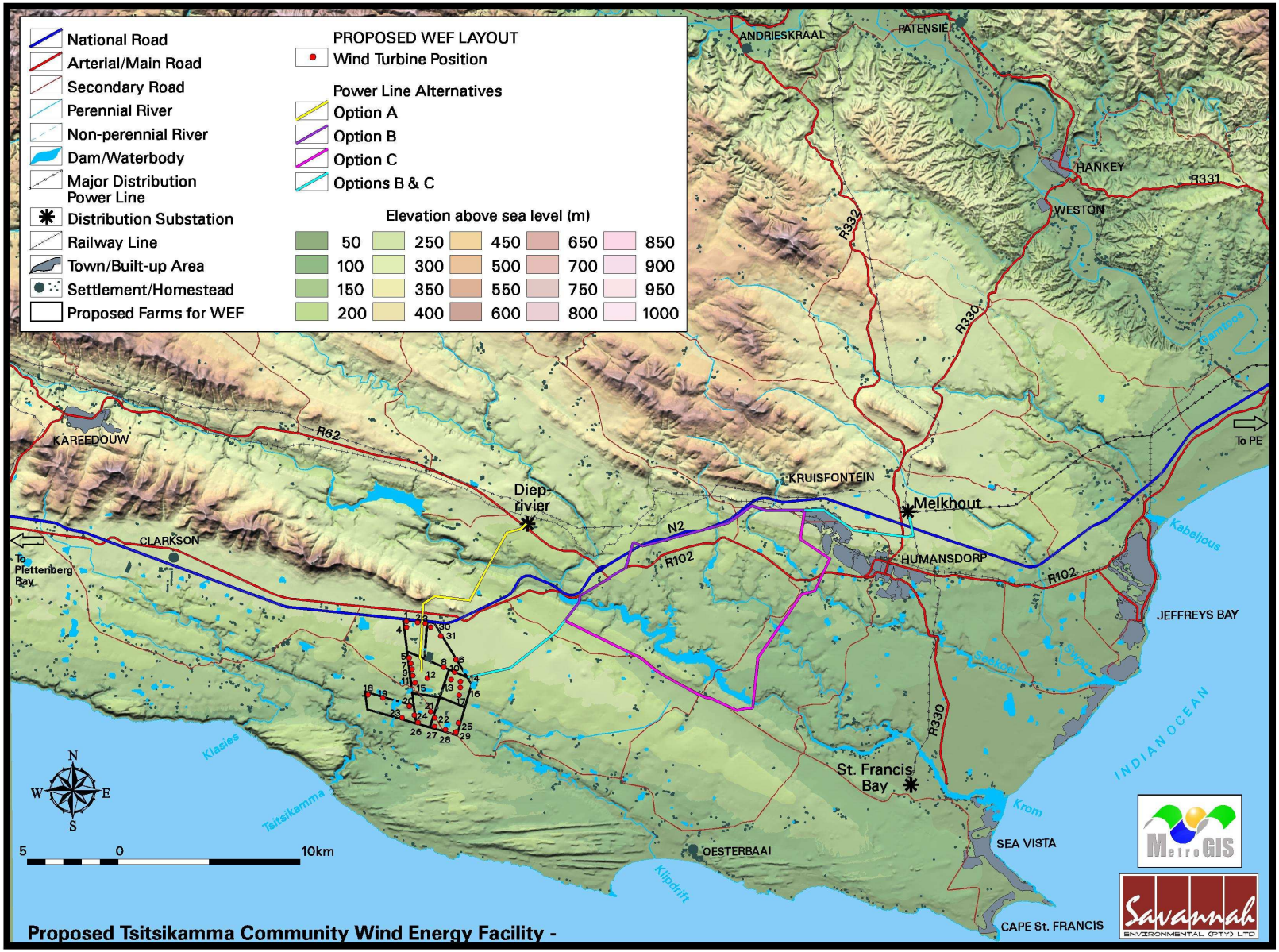

Figure 7.1: Locality map showing the site within the broader area, including the provisional wind turbine layout and alternative power line corridors

In summary, the conclusions of the impact assessment are as follows:

» Overall the proposed wind energy facility is likely to have a **medium-low** local and regional negative impact on the **ecology** on site, prior to mitigation. This could be reduced to **low after mitigation**. The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation in development footprints, and direct, long-term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc. during the construction phase. A number of impacts associated with this project are due to the fact that some of the infrastructure is proposed to be positioned close to wetlands & watercourses. A slight shifting in the positions of these turbines (specifically turbine 8, 17 and 25) will minimise this potential impact.
» The primary concern for the proposed facility in terms of **avifauna** will be that of collision of birds with the turbines and earth wires of the power line. This impact on avifauna is potentially of **medium - high** significance, but could be reduced to a **medium - low significance** with the implementation of mitigation measures. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended (and outlined in the avifauna specialist study), from pre-construction into the operational phase of the project.
» The findings of the **geology and soils** study indicate the most important impacts on geology and soils include soil degradation (including erosion). The geological setting is not typically prone to erosion but minor erosion will occur in areas where run-off is concentrated. The significance of the main direct impacts that have been identified is considered **low to moderate** due to the localised and limited extent of the proposed activity and the anticipated geology which appears to be generally favourable towards the proposed layout. An assessment of the potential geotechnical constraints on the project indicates no insurmountable problems which have may have an impact on the design and construction processes. Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary degradation of soil. Special attention to be given to roads that cross drainage lines.
» The **agricultural potential and land use** study indicated that the project could have impacts on indentified highly sensitive areas. The significance of this impact was rated as being **low** if turbines are shifted out of high sensitivity areas (specifically turbines no 8, 17 and 25).
» The results of the **heritage** survey suggest that the impacts associated with turbine and other infrastructure footprints would have a **negligible impact** on the archaeological material in the study area. Impacts on **fossil** material are potentially of **moderate** significance. A Phase 1 field assessment study by a professional palaeontologist is recommended to identify any palaeontological hotspots and make specific recommendations for any

mitigation required before or during the construction phase of the development. This will decrease the significance of this potential impact to **low**.

» It is envisaged that the structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing at homesteads or visiting the region), especially within a 5 to 10 km radius (i.e. at short to medium distances) of the facility and would constitute a high visual prominence, potentially resulting in a **high visual impact**. This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure. Furthermore this impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres such as Jeffrey's Bay, Sea Vista and Oyster Bay.
» The potential for **noise impact** on surrounding areas (outside of the development footprint) is of **low significance**. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of **medium significance** on two of the identified sensitive receptors, but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a **low** significance. Care must be taken to ensure that the operations at the wind energy facility do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.
» The majority of the potential **negative impacts on the social environment** as a result of the construction and operation of the wind energy facility are expected to be of **moderate to low significance**, with implementation of the recommended mitigation measures. A number of **positive impacts** have been identified, which could be further enhanced if managed effectively.

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

» Impacts on land use and agricultural potential
» Visual impacts on the natural scenic resources of the region imposed by the components of the facility (most specifically the turbines)
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the access roads, substation and power line.
» Impacts on the social environment.

These are explored in further detail below:

7.1.1. Visual impacts on the natural scenic resources of the region imposed by the components of the facility

The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed by the components of the facility. The facility is likely to be visible for up to 10km from the site. The highest frequency of potential visual exposure is on the site itself and on the coastal plain to the immediate west and east of the site. The areas lying above the plateau to the north are mostly screened by the high-lying topography.

Long strips along the numerous drainage lines in close proximity to the site are screened as incision by the rivers into the landscape effectively shields these areas from potential visual exposure. The Krom River valley also offers large areas of visual screening due to topography. Similarly, many areas along the coastline are visually screened as the landscape drops down to sea level.

Beyond the Krom River to the north east, the frequency of visual exposure appears to increase with distance from the proposed facility. This is due to the rising topography, and specifically the south facing slopes of the mountains, which orientate towards the proposed site.

Visibility of the facility will be high, with a high frequency of exposure for stretches of the N2 and the R102, especially below the plateau in close proximity to the proposed facility. Beyond the plateau to the north, the frequency of exposure first drops to low, and then increases to moderate. Shorter stretches of the R330 and of the R62 in the vicinity of Diep Rivier Distribution Substation will be exposed to lower frequencies of potential visual exposure. The R331 and R332 will not be exposed.

The towns of Kruisfontein and Humansdorp to the north east, Oyster Bay to the south east and Clarkson to the north-west are expected to experience a moderate to high frequency of visual exposure, both within the towns and in the surrounding area.

The western parts of Jeffrey Bay and the outskirts of Sea Vista are likely to experience lower frequencies of potential visual exposure. It should be noted, however, that these two towns are located more than 20km from the proposed facility.

In addition, a large number of settlements and homesteads, especially those located below the plateau will be potentially visually exposed, with a high frequency of exposure. The proposed facility may also be visible from limited parts of the Thaba Manzi, the Jumanji and Lombardini Game Farms, as well as the Thyspunt Natural Heritage Site and the State Forest. Very limited parts of the Kromrivierspoort National Heritage Site, the Huisklip Nature Reserve and Klasies River Cave may be exposed to moderate to high frequencies of potential visual exposure. The visual impact on the Thuyspunt Natural Heritage Site will be of low significance.

It is envisaged that the wind turbine structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing at homesteads or visiting the region), especially within a 5 to 10 km radius (i.e. at short to medium distances) of the facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

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

Figure 7.2 View southeast on a secondary road leading to Oyster Bay

The viewpoint in Figure 7.2 is located on a secondary road which extends from the N2 to the south east, eventually crossing over the site. The point is located about 2km west of the site boundary. This position is approximately 1,4km away from the closest turbine and is indicative of a close range view that residents of homesteads living in close proximity to the facility would have of the turbines.

7.1.2. Land use impacts associated with the construction and operation of the facility

The agricultural potential of the site is directly linked to the soils. In the cases where irrigation infrastructure has been established the potential of the soils increases to high. The agricultural use on site is currently limited to grazing with improved pastures under irrigation as well as plantations.

The wetlands identified during the aerial photograph interpretation are more extensive than other drainage features. Most of the wetlands within the agricultural areas have been impacted severely but a few areas still appear relatively intact. The presence of pastures and cattle production has already lead to significant impact on the site relating to erosion and sediment generation and eutrophication. Some of the turbines are situated on the edge of potential wetland zones and could be excluded once a dedicated wetland delineation study has been conducted.

For the development of the wind energy facility, the overall soil impacts are expected to be relatively low for the shallow soil zones but will be very high for areas with established irrigation infrastructure. Impacts are generally restricted to small areas around the turbine foundation as well as the transmission and road infrastructure. Erosion control measures will have to be implemented to prevent and contain erosion associated with soil surface disturbance due to construction activities. Some of the turbines are situated on the edge of potential wetland zones and could be required to be relocated once a dedicated wetland delineation study has been conducted.

7.1.3. Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility

A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of ~54 km^2 was considered for the facility. The bulk of this effective area required for the facility footprint would not suffer any level of disturbance as a result of the required activities on site.

Permanently affected areas (excluding the power line footprints, which will mostly be situated off-site) comprise up to 31 proposed turbine footprints (31 foundation areas of 15 m x 15 m in extent), access roads (to be rehabilitated to 6 m in width), substation footprint (up to 25 m x 25 m in extent) and a workshop area (100m^2). The area of permanent disturbance is calculated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**

31 turbine footprints (each 15 m x 15 m)	6975
~ 28.5 km of permanent access roads (6 m in width)	171000
Substation footprint (25 m x 25 m)	625
Workshop area	100
TOTAL	**178700** (of a total area of ~54 000 000) **= 0.33 % of site**

Temporarily affected areas comprise the temporary laydown areas as well as a track of up to 12 m in width for the crane to move across the site (i.e. an additional 6 m width to the permanent road of 6 m in width). The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
Temporary storage area	10000
Temporary crane travel track adjacent to access road ~28.5 km PLUS trench for cabling	171000
31 laydown areas (each 25 m x 50 m)	38 750
TOTAL	**219750** (of a total area of 54 000 000) **= 0.41 % of site**

Therefore, a total area of 398450 m^2 can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to **0.74 %** of the total area which will form part of the total wind energy facility site.

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

» High sensitivity ecological areas
» High sensitivity areas in terms of land use, wetland zones and agricultural potential
» Potentially sensitive noise receptors

From the specialist investigations undertaken for the proposed wind energy facility site, several environmentally sensitive areas were identified with regard to potential ecological impacts.

Figure 7.3 indicates an area of high ecological sensitivity. Factors that may lead to parts of the study area having high ecological sensitivity are the presence of wetlands, drainage lines, potential presence of erodable substrates, the potential presence of various plant and animal species of conservation concern, and protected trees. It is especially important that the estuaries are not affected by

activities on site, for example, increased water turbidity due to erosion of substrates into upper reaches of watercourses. Should mitigation measures be adhered to, impacts can be adequately managed.

As far as possible, wind turbines and associated laydown areas and access roads which could potentially impact on sensitive areas should be relocated in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not technically feasible or viable, alternative mitigation measures as detailed in this report must be implemented.

Exxaro Resources and Watt Energy should also establish an ongoing monitoring programme to detect, quantify and control any alien plant species that may become established on site.

Disturbance to the site during the establishment of the facility will alter habitats on the site, which could disturb resident birds during the construction phase. During operation of the facility, the threat of collision of avifauna with the turbine blades is the most significant impact. However, the real extent of this potential risk is not currently well understood within the South African context.

The proposed development will possibly affect populations of regionally or nationally threatened (and impact susceptible) birds (mainly raptors and large terrestrial species) likely to occur within or close to the proposed turbines. The facility will probably have a detrimental impact on these birds, particularly during its operational phase, unless commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South African avifauna. The impacts of this development must be viewed in the context of the potential cumulative effects generated by at least five other wind energy project proposed for the same general area.

It is also considered essential that the bird interactions which do take place with the establishment of the facility are fully documented. To this end, the initiation of a comprehensive pre-and-post commissioning monitoring programme, and a longer-term scheme for surveying bird movements in relation to the wind energy facility and fully documenting all collision (or electrocution with power line infrastructure/substation) casualties, is considered critical. Such a monitoring programme will also inform and refine any post-construction mitigation of impacts which might ultimately be required.

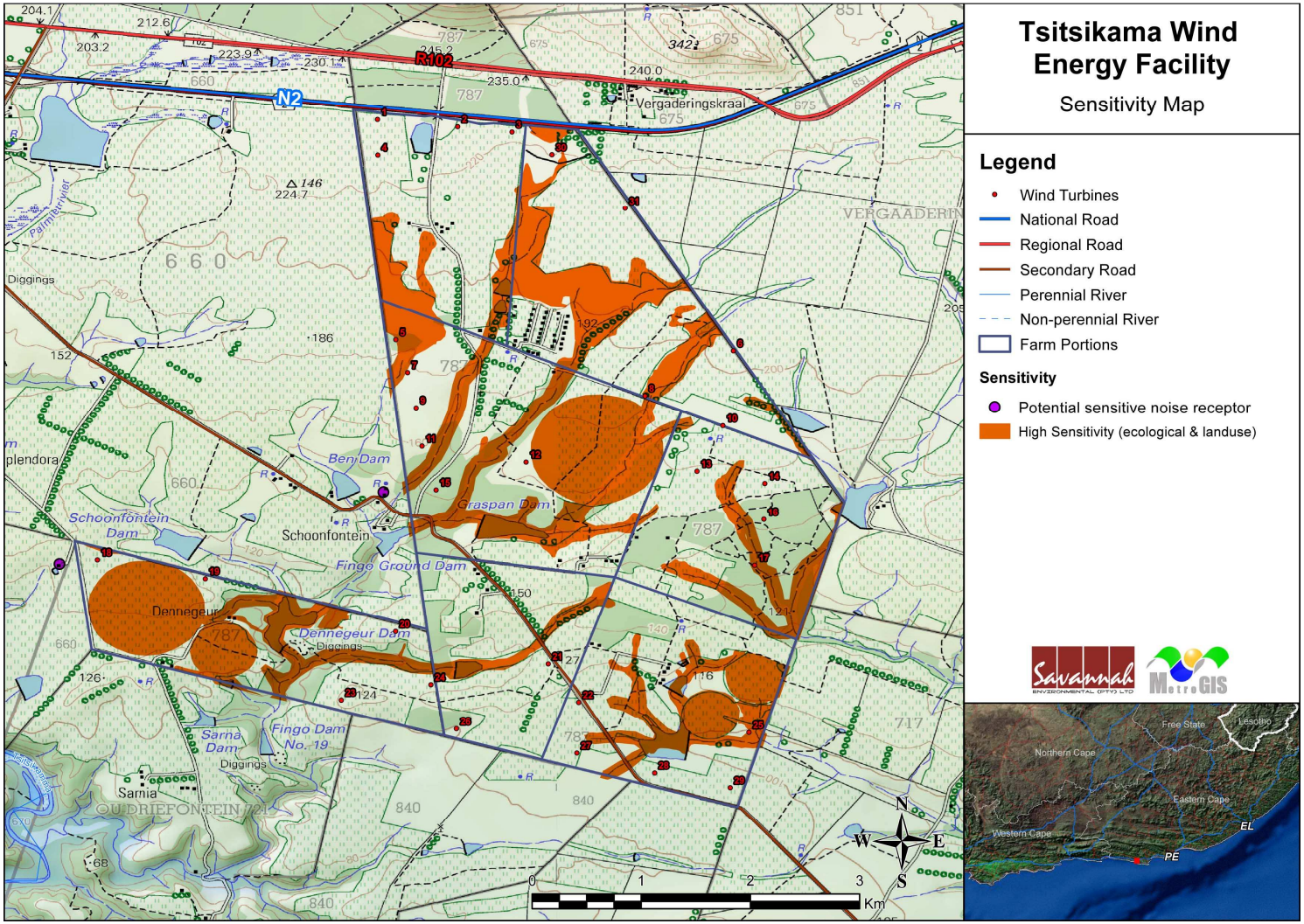

Figure 7.3: Combined sensitivity map for the project study area illustrating identified potentially sensitive areas in relation to the wind energy facility layout: areas of high ecological sensitivity, areas sensitivity in terms of land use and potential noise receptors (refer to Appendix P for an A3-size version of this map)

In order to reduce potential impacts on sensitive areas it is suggested that:

» Planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should be used as far as possible for providing access to proposed turbine positions. Road infrastructure and cable alignments should coincide as much as possible.
» As a precaution, a preconstruction survey for *Protea coronata* should be undertaken at the location of the turbines (and access roads to turbines) 1, 2 and 3 to determine whether this species occurs within the footprint of the infrastructure or not. Exxaro Resources and Watt Energy should undertake a pre-construction walk-through survey of the servitude of the selected power line route to determine whether any individuals of plant species of concern occur there or not.
» Turbine 8 should be moved 30 m westwards along the existing access track and turbine 25 should be moved 20 m south-west of its current position.
» The workshop area, any interim construction facilities and temporary laydown areas should located away from any identified sensitive areas
» A wetland delineation study should be conducted to further define wetland zones on site. Wetland areas should be considered no-go areas for development of wind turbines. Where these cannot be avoided, a water use license will be required to be obtained from the Department of Water Affairs.
» Existing roads should be used as far as possible. Where new roads are required, these should be planned taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
» A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area be implemented to cover the pre-construction environment as well as the operational phase of the project (Appendix H and Appendix O).
» The developer must consider the various mitigation options as suggested in the noise EIA assessment (Appendix M) to reduce the significance of the potential noise impact on any sensitive receptors to an impact of lower significance.

7.1.4. Impacts associated with access roads, the on-site substation and the power line

Internal access roads are required for construction and operation (maintenance) of wind turbines). Where possible, they will run along any existing roads or vehicle tracks. Based on pre-feasibility studies there are up to ~ 28.5 km of internal access roads proposed across the development footprint, however some

of these will make use of existing access roads, so the length of new access roads would in reality be considerably less of this (approximately 15 km of new roads). The major impacts associated with the access roads will be the ecological impacts (potential impacts on wetlands, loss of habitat within indigenous natural vegetation types and spread of alien species), avifaunal impacts (habitat destruction and disturbance) and direct impacts on soil (soil erosion and degradation). These impacts can be successfully mitigated against if the mitigation measures proposed in the EIA specialist reports are implemented.

A *single substation* will be constructed within the site footprint. Each wind turbine will be connected to the proposed substation by underground electrical cables (33 kV cables). A new distribution power line is proposed to connect the substation in the facility to the Diep Rivier Substation ~8km north of the site or alternatively the Melkhout Substation approximately 25 km northeast of the site. The power line and substation infrastructure within the facility is not expected to be highly noticeable amidst the much taller wind turbines and are therefore not expected to pose a significant visual impacts. Some localised visual impacts may occur during the construction phase as trenching and backfilling will occur, but these activities and their related impacts are not expected to be significant in comparison the construction of the wind turbines.

Three alignment alternatives are under consideration for this power line

» **Option A** exits the site on its northern boundary and runs north, crossing over the N2 and the R102. Thereafter it turns to the east to connect with the national grid at the Diep Rivier Distribution Substation. The length of this option is 11,91km. **However** Diep Rivier Substation cannot currently receive voltages as high as the 132 kV that would be received from the proposed wind energy facility. Option A can only be utilized in the event of the Diep Rivier Substation being upgraded by Eskom in order to receive the higher voltage current that would be generated by the facility.

  In the event that the Diep Rivier substation is not upgraded, Option B or Option C to Eskom's existing larger Melkhout Substation will be required to be utilised:

» **Option B** exits the site on its north eastern boundary and runs to the north east until it reaches the N2. It follows the alignment of the N2 for some distance, turning to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 29,76km.

» **Option C** exits the site on its north eastern boundary and runs to the north east for about 5km before turning to the south east. Some 10km further on,

the alignment bends back to the north east before it turns sharply to the east just before Kruisfontein. Beyond the R330, the alignment turns to the north to connect with the national grid at the Melkhout Distribution Substation. The length of this option is 38,59km.

The construction of the power line will generally have medium to low impacts on the ecology of the study area.

Habitat destruction and disturbance with regard to avifauna associated with construction of the power lines and substation should be mitigated against. Electrocution on power line infrastructure has a potential impact on birds, which should be monitored through the proposed bird monitoring programme and mitigated through the use of bird diverters in areas where required.

It is clear that all options for the proposed power line will be highly visible although areas of visual screening occur in areas of undulating topography and along incised river valleys. In order of preference, Option A is favoured from a visual perspective followed by Option C. Option B is considered the least favourable.

Table 7.1: Preferred power line route recommendations from specialist studies

	Overall preferred option (Option A, Option B and Option C)	**Preference between Option B and Option C for connection to Melkhout Substation**
Ecology	Option B or C	No preference
Avifauna	Option A	No preference
Geology	Option A	No preference
Soils / Agricultural Potential	No preference	No preference
Heritage	No preference	No preference
Paleontology	No preference	No preference
Visual	Option A	Option C
Noise	No preference	No preference
Social	Option A	Option C

7.1.5. Impacts on the social environment

Based on the findings of the Social Impact Assessment, the landowners who stand to be directly affected by the proposed wind energy facility are not opposed to the development.

Impacts on the social environment are expected during both the construction phase and the operational phase of the wind energy facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the wind energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

No construction crew camp will be established on the site, and construction workers will be housed in neighbouring formal towns. Construction activities on the site will be restricted to daylight hours.

The findings of the social impact study also indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures listed in the report to address the potential negative impacts during the construction phase should also be implemented.

7.2. Cumulative Impacts

Based on the information available at the time of undertaking the EIA, it would appear that at least five other wind energy facilities are proposed in the immediate region. These include:

» the authorised RedCap Kouga Wind Energy Facility located ~3 km south of the site,
» the authorised Deep River Wind Energy Facility located ~3 km northeast of the site,
» the proposed Happy Valley Wind Energy Facility located ~12 km northeast of the site,
» the authorised Jeffrey's Bay Wind Energy Facility located ~30 km east of the site, and
» the proposed Oyster Bay Wind Energy Facility located ~6 km southest of the proposed site.

The cumulative impacts associated with the proposed wind energy facilities from a social perspective relate largely to the impact on sense of place and visual impacts. The area designated for the proposed facility projects is rural and agricultural in nature. This impact will be exacerbated by the sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail) of the sites, specifically for motorists travelling along the N2. The dominant current land use activity in the area is livestock farming. The proposed wind energy facilities will alter the sense of place and the existing landscape which will be dominated by turbines. In this regard a number of

residents in the immediate/local area to this site raised concerns regarding the cumulative impacts associated with the establishment of multiple wind energy facilities in the Hummansdorp, Jeffreys Bay, St Francis Bay and Cape St Francis area. They were not opposed to wind energy *per se*, however, concerns were raised regarding the number of proposed facilities being mooted in the area.

Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts on birds to sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South African avifauna. The impacts of this development must be viewed in the context of the potential cumulative effects generated by multiple other wind energy project proposed for the same general area. The cumulative impact of these projects on the utility of the area for Denham's Bustard is of particular concern.

The visual visibility of the turbines will be the single largest change to the Klasies River / Klippepunt pre-colonial cultural landscape and will impact on the meaning of 'sense of place'. By adding another large number of turbines, the proposed Tsitsikamma Community Wind Energy Facility will contribute to the 'accumulative visual impact' on the pre-colonial cultural landscape and change to the 'significance of place'. The suggestion was that this could be mitigated by shifting turbines out of the 2km buffer from the coastal zone to decrease the impact (this will affect turbines 18 – 29). However as confirmed by the Visual Impact Assessment findings (Appendix L) the visual impact on the Thuyspunt Natural Heritage Site will be of **low significance** and the shifting of turbines away from the coastline will not significantly lessen the visual impact. Therefore this mitigation measure is not supported by the findings of the visual assessment and is considered unnecessary.

7.3. Overall Conclusion (Impact Statement)

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

Through pre-feasibility assessments and research, the viability of establishing a wind energy facility on in the Tsitsikamma area of the Eastern Cape has been

established by Exxaro Resources and Watt Energy. The positive implications of establishing a wind energy facility on the demarcated site within the Eastern Cape include:

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

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the wind energy facility layout.

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

The proposed substation position and power line corridors are considered to be acceptable from an environmental perspective. The proposed power line should follow the alignment **Option A** to Diep Rivier Substation in order to minimise potential visual and ecological impacts. In the event that connection to Diep Rivier Substation is not possible the proposed power line should follow **Option C** to Melkhout Substation. Option B is not preferred due to greater associated potential visual impacts (refer to Table 7.1).

The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

7.3. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility

and associated substation and distribution power line, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Tsitsikamma Community Wind Energy Facility is not fatally flawed.

The visual impact associated with the facility is the primary impact which cannot be significantly mitigated. However the impact of high significance is restricted to within a distance of 5 - 10 km of the site.

The following infrastructure would be included within an authorisation issued for the project:

» Construction of the Wind Energy Facility with up to **31 wind turbine units**, and all **associated infrastructure** (access roads to site, internal access roads, workshop building)
» Construction of a single **substation** on the site.
» **Overhead power line** (of up to 132kV) linking the wind energy facility to the Eskom electricity distribution network via the existing Diep Rivier Substation as proposed in Figure 7.1 to follow the proposed **Option A** route. Alternatively to follow proposed **Option B** route to Melkhout substation if connection to Diep Rivier is not feasible.

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

» Mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.
» The draft Environmental Management Plan (EMP) as contained within Appendix O of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Disturbed areas should be rehabilitated as quickly as possible once construction in an area is completed, and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Mitigate secondary visual impacts associated with the construction of roads through the use of existing roads wherever possible.
» A monitoring program should be initiated in order to collect data on the numbers of birds and bats affected by the wind energy facility.

- The developer should consider the various mitigation options as proposed in the noise assessment to reduce the significance of the potential noise impact on any sensitive receptors. Should the layout (or type of wind turbines used) change significantly during the final design, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.
- The final location of the wind turbines and associated infrastructure must be informed by surveys undertaken by an ecological, avifaunal and heritage specialist. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
- The positions of turbines 8, 17 and 25 should be revised to avoid sensitive areas on wetlands / watercourses. It is suggested that a wetland delineation study is conducted to further refine areas of sensitivity. If turbines are found to be located in areas of high sensitivity their positions should be revised.
- The workshop area, any interim construction facilities and temporary laydown areas should located away from any identified sensitive area
- A preconstruction survey for *Protea coronata* should be undertaken at the location of the turbines (and access roads to turbines) 1, 2 and 3.
- Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- A Phase 1 field assessment study by a professional palaeontologist is recommended to identify any palaeontological hotspots and make specific recommendations for any mitigation required.
- An on-going monitoring programme should be established to detect, quantify and control any alien plant species within the project site.
- A comprehensive stormwater management plan should be compiled for the facility footprint prior to construction.
- Applications for all other relevant and required permits required to be obtained by Exxaro Resources and Watt Energy and must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any riparian vegetation or wetlands.

REFERENCES CHAPTER 8

1:250 000 Geological map 3324 Port Elizabeth (1990). Council for Geoscience, Pretoria.

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

ACOCKS, J.P.H. 1988. Veld types of South Africa (3rd edn.). Mem. Bot. Surv. S. Afr. No 28. Government printer, Pretoria.

ALEXANDER, G. & MARAIS, J. 2007. A guide to the reptiles of southern Africa. Struik, Cape Town.

Allan, D.G. & Jenkins, A.R. 1990. West Coast heavy mineral sands project: Birdlife on the proposed mining site. Unpublished report. University of Cape Town, Cape Town.

Allan, D.G. 1994. The abundance and movements of Ludwig's Bustard *Neotis ludwigii*. *Ostrich* 65: 95-105.

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.

ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria.
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.

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.
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.

BERLINER, D. & DESMET, P. 2007. Eastern Cape Biodiversity Conservation Plan Technical Report. Department of Water Affairs and Forestry Project No. 2005 - 012, Pretoria.

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.

Binneman, J.N.F. & Hall, S.L. 1993. The context of four painted stones from the Eastern Cape. Southern African Field Archaeology 2:89-95.

Binneman, J.N.F. 1996. The symbolic construction of communities during the Holocene Later Stone Age in the south-eastern Cape. Unpublished D.Phil. thesis: University of the Witwatersrand.

Binneman, J.N.F. 1997. Results from a test excavation at The Havens Cave, Cambria, south- eastern Cape. Southern African Field Archaeology 6:93-105.

Binneman, J.N.F. 1998. Results from a test excavation at Kleinpoort Shelter in the Baviaanskloof, Eastern Cape Province. Southern African Field Archaeology 7:90-97.

Binneman, J.N.F. 1999a. Results from a test excavation at Groot Kommandokloof Shelter in the Baviaanskloof/Kouga region, Eastern Cape Province. Southern African Field Archaeology 8:100-107.

Binneman, J.N.F. 1999b. Mummified human remains from the Kouga Mountains, Eastern Cape. The Digging Stick 16:1-2.

Binneman, J.N.F. 2000. Results from two test excavations in the Baviaanskloof Mountains, Eastern Cape Province. Southern African Field Archaeology 9:81-92.
Binneman, J.N.F. 2001. An introduction to a Later Stone Age coastal research project along the south-eastern Cape coast. Southern African Field Archaeology 10:75-87.

Binneman, J.N.F. 2005. Archaeological research along the south-eastern Cape coast part1: open-air shell middens Southern African Field Archaeology 13 & 14:49-77. 2004/2005.

Binneman, J.N.F. 2007. Archaeological research along the south-eastern Cape coast part2, caves and shelters: Kabeljous River Shelter 1 and associated stone tool industries Southern African Field Archaeology 15 & 16:57-74.

Boshoff, A., Barkhuysen, A., Brown, G. & Michael, M. 2009. Evidence of partial migratory behavior by the Cape Griffon *Gyps coprotheres*. *Ostrich* 80: 129-133.

Boshoff, A., Piper, S. & Michael, M. 2009. On the distribution and breeding status of the Cape Griffon *Gyps coprotheres* in the Eastern Cape, province, South Africa. *Ostrich* 80: 85-92.

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

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.

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

Butzer , K.W. 1978. Sediment stratigraphy of the Middle Stone Age sequence at Klasies River Mouth, Tsitsikama Coast, South Africa. South African Archaeological Bulletin 33:141-151.

Cacadu District Municipality Integrated Development Plan (IDP) (2007-2012)

Carrion, J.S., Brink, J.S., Scott, L. & Binneman, J.N.F. 2000. Palynology and palaeoenvironment of Pleistocene coprolites from an open-air site at Oyster Bay, Eastern Cape coast. South African Journal of Science 96:449-453.

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

Crawford, R.J.M. & Taylor, R.H. 2000. White Pelican. *In:* Barnes, K.N. (ed.). The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Cape Town. pp. 136.

Crawford, R.J.M., Cooper, J. & Dyer, B.M. 1995. Conservation of an increasing population of Great White Pelicans *Pelecanus onocrotalus* in South Africa's Western Cape. *S. Afr. J. Mar. Sci.* 15:33-42.

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.

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

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.

Curtis, O., Simmons, R.E. & Jenkins, A.R. 2004. Black Harrier *Circus maurus* of the Fynbos biome, South Africa: a threatened specialist or an adaptable survivor? *Bird Conservation International* 14: 233-245.

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.

Deacon, H. J & Shuurman, R. 1992. The origins of modern people: the evidence from Klasies River. In: Bräuer, G. & Smith, F. H., eds, Continuity or replacement: controversies in Homo sapiens evolution. Rotterdam: Balkema, pp. 121–9.

Deacon, H. J. & Wurz, S. 1996. Klasies River Main Site, Cave 2: a Howiesons Poort occurrence. In: Pwiti, G. & Soper, R., eds, Aspects of African Archaeology. Harare: University of Zimbabwe Publications, pp. 213–8.

Deacon, H.J. & Geleijnse, V. 1988. The stratigraphy and sedementtology of the Main Site sequence at Klasies River, South Africa. South African Archaeological Bulletin 43:5-14.

Deacon, H.J. & Deacon, J. 1999. Human beginnings in South Africa: uncovering the secrets of the Stone Age. Cape Town: David Phillips Publishers.

Deacon, H.J. 1967. Two radiocarbon dates from Scott's Cave, Gamtoos Valley. South African Archaeological Bulletin 22:51-52.
Deacon, H.J. 1992. Southern Africa and modern human origins. Philosophical Transactions of the Royal Society, London 337: 177–83.

Deacon, H.J. 1993. Southern Africa and modern human origins. In: Aitken, M. J., Stringer, C. B. & Mellars, P. A., eds, The origin of modern humans and impact of chronometric dating. Princeton: Princeton University Press, pp. 104–17.

Deacon, H.J. 1995. Two Pleistocene-holocene archaeological depositories from the southern Cape, South Africa. South African Archaeological Bulletin 50:121-131.
Deacon, H.J. 2001. Modern human emergence: an African archaeological perspective. In: Tobias, P. V., Raath, M. A., Moggi-Cecchi, J. & Doyle, G. A., eds, Humanity from African Renais-sance to coming Millennia. Johannesburg: University of the Witwatersrand Press, pp. 213– 22.

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.

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

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.

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 (Pty) Ltd, Cape Town.
Eastern Cape Provincial Growth and Development Programme (PGDP) (2004-2014)
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.

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.

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

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.

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.

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.
Geological Survey, 1990. 1:250 000 scale geological map 3324 Port Elizabeth. Department of Mineral and Energy Affairs, Pretoria.

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.

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.
GROOMBRIDGE, B. (ed.) 1994. 1994 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

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.
Henderson, Z. 1992. The context of some Middle Stone Age hearths at Klasies River Shelter 1B: implications for understanding human behaviour. Southern African Field Archaeology 1:14-26.

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.

HOARE, D.B., MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. Albany Thickets. in Mucina, L. and Rutherford, M.C. (eds.)

2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

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.

Identification of Problematic Soils in Southern Africa (2007). Technical notes for civil and structural engineers. Published by the Department of Public Works.
IUCN (2001). IUCN Red Data List categories and criteria: Version 3.1. IUCN Species Survival Commission: Gland, Switzerland.

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. 1998. Site evaluation for Namakwa Sands heavy minerals sands mine. Unpublished report to the Environmental Evaluation Unit. University of Cape Town, Cape Town.

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. 1994. The influence of habitat on the distribution and abundance of Peregrine and Lanner Falcons in South Africa. Ostrich 65: 281-290.

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. 2011. Winds of change: birds and wind energy development in South Africa. *Africa – Birds & Birding* 15(6): 35-38.

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.

Kerlinger, P., Gehring, J.L., Erickson, W.P., Curry, R., Jain, A. & Guarnaccia, J. 2010. Night migrant fatalities and obstruction lighting at wind turbines in North America. *The Wilson Journal of Ornithology* 122: 744-754.

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.

Klein, R.G. 1976. The mammalian fauna from the Klasies River Mouth sites, southern Cape Province, South Africa. South African Archaeological Bulletin 3:75-98.

Koch, F.G.L., 2003. Land types of the maps 3224 Graaf-Reinet and 3324 Port Elizabeth (Climate). Mem. Nat. Agric. Res. S. Afr. No. 33. ARC-Institute for Soil, Climate and Water, Pretoria.

KOPKE, D. 1988. The climate of the Eastern Cape. In: M.N. Bruton & F.W. Gess. (ed.) Towards an environmental plan for the Eastern Cape. Rhodes University, Grahamstown.

Kouga Local Municipality Integrated Development Plan (IDP) (2007-2012).

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.
Laidler, P.W. 1947. The evolution of Middle Palaeolithic technique at Geelhoutboom, near Kareedouw, in the southern Cape. Transactions of the Royal Society of South Africa 31:283-313.

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.

LOW, A.B. & REBELO, A.G. (1998) Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria.

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.

MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

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.

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.

MITTERMEIER, R.A., GIL, P.R., HOFFMANN, M., PILGRIM, J., BROOKS, T., MITTERMEIER, C.G., LAMOREUX, J. & FONSECA, G.A.B. DA (eds.) Hotspots revisited. CEMEX, pp.218–229. ISBN 968-6397-77-9

MONADJEM, A., TAYLOR, P.J., COTTERILL, E.P.D. & SCHOEMAN, M.C. 2010. Bats of southern and central Africa. Wits University Press, Johannesburg.

MUCINA, L, BREDENKAMP, G.J., HOARE, D.B & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa South African Journal of Science 96: 1–2.
MUCINA, L. AND RUTHERFORD, M.C. (editors) (2006). Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, National Botanical Institute, Pretoria.

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., ADAMS, J.B., KNEVEL, I.C., RUTHERFORD, M.C., POWRIE, L.W., BOLTON, J.J., VAN DER MERWE, J.H., ANDERSON, R.J., BORNMAN, T.G., LE ROUX, A. & JANSSEN, J.A.M. 2006. Coastal Vegetation of South Africa. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. 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., HOARE, D.B. & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.

Mucina. L. & Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

MUELLER-DOMBOIS, D. AND ELLENBERG, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.

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

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.

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

Oosthuizen, A.B., De Corte, A.W.M., Schloms, B.H.A., Rudman, R.B., Robertson, T.A., and Fullstone, M.J., 2001. Land types of the map 3324 Port Elizabeth. Field information. Mem. Nat. Agric. Res. S. Afr. No. 26. ARC-Institute for Soil, Climate and water, Pretoria.

Partridge, T.C. and Maud, R.R. (1987) Geomorphic eveolution of southern Africa since the Mesozoic. S. Afr. J. Geol. 90(2): 179-208.

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

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.

REBELO, A.G., BOUCHER, C., HELME, N., MUCINA, L. & RUTHERFORD, M.C. 2006. Fynbos Biome. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

Republic of South Africa (2003). White Paper on Renewable Energy.

Republic of South Africa (2008). National Energy Act, Act nr. 34 of 2008.

Republic of South Africa (December 1998). White Paper on Energy Policy.

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.

Rightmire, G.P. & Deacon, H.J. 1991. Comparative studies of Late Pleistocene human remains from Klasies River Mouth, South Africa. Journal of Human Evolution 20:131-156.

RUTHERFORD, M.C. & WESTFALL, R.H. (1994). Biomes of southern Africa: an objective categorization. Memoirs of the Botanical Survey of South Africa No. 63.
SACS (1980). Stratigraphy of South Africa. Handbook 8, Geological Survey, Department of Mineral and Energy Affairs, Government Printer, 690pp.

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

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

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

SCHULZE, B.R. 1984. Climate of South Africa, Part 8, General Survey, WB 28. South African Weather Bureau 60. Government Printer, Pretoria.

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.

Singer, R. & Wymer, J. 1982. The Middle Stone Age at Klasies River Mouth in South Africa. Chicago: University of Chicago Press.

SKELTON, P. 2001. A complete guide to the freshwater fishes of southern Africa. Struik Publishers, Cape Town.

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.

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., HOARE, D.B., DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) Hotspots revisited. CEMEX, pp.218–229. ISBN 968-6397-77-9

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., HOARE, D.B., DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. http://www.biodiversityhotspots.org/xp/hotspots/maputaland/.

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., HOARE, D.B., DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2004. Maputaland-Pondoland-Albany Hotspot. In:

Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) Hotspots revisited. CEMEX, pp.218–229. ISBN 968-6397-77-9

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.

Steyn, M., Binneman, J.N.F. & Loots, M. 2007. The Kouga Mummified remains. South African Archaeological Bulletin 65:3-8.

Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape. Towards a Regional Methodology for Wind Energy Site Selection (May 2006).

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.

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

The White Paper on the Energy Policy of the Republic of South Africa, December 1998.

Tinley,K.L. 1985. Coastal dunes of South Africa. South Africa National Programme Report No. 109.

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.

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

Van Zyl, A.J, Jenkins, A.R. & Allan, D.G. 1994. Evidence for seasonal movement by Rock Kestrels *Falco tinnunculus* and Lanner Falcons *F. biarmicus* in South Africa. *Ostrich* 65:111-121.

W.J. de Klerk (2010). Palaeontological Heritage Impact Assessment of the proposed wind farms in the coastal region of the Kouga Local Municipality near the villages of Oyster Bay and St. Francis Bay. Specialist Technical Report prepared for Arcus Gibb.

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.

WEATHER BUREAU 1996. Climate data for stations from the Eastern Cape.
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.

WESTHOFF, V. AND VAN DER MAAREL, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.
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.

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

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

Wurz, S. 1999. The Howiesons Poort backed artefacts from Klasies River: an argument for symbolic behaviour. South African Archaeological Bulletin 54: 38–50.

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.

Internet sources

http://www.madehow.com/images/hpm_0000_0001_0_img0219.jpg
Department of Water Affairs website (www.dwaf.gov.za).
www.demarcation.org.za (Census 2001 data).
http://www.ecprov.gov.za
National Department of Environmental Affairs (www.environment.gov.za).

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