ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT IMPACT ASSESSMENT REPORT

PROPOSED GOEREESOE WIND FARM, NEAR SWELLENDAM

WESTERN CAPE PROVINCE
(DEA Ref: 12/12/20/2199)

DRAFT FOR PUBLIC REVIEW
February 2013

Prepared for:

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PROJECT DETAILS

DEA Reference No.	:	12/12/20/2199
Title	:	Environmental Impact Assessment Process Draft EIA Report: Proposed Goereesoe Wind Farm near Swellendam in the Western Cape Province
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Project Developer	:	IE Swellendam Wind (Pty) Ltd
Report Status	:	Draft EIA Report for public review
Review Period	:	20 February 2013 to 22 March 2013

When used as a reference this report should be cited as: Savannah Environmental (2013) Draft EIA Report: Proposed Goereesoe Wind Farm near Swellendam in the Western Cape Province

PURPOSE OF THE DRAFT EIA REPORT

IE Swellendam Wind (Pty) Ltd (a subsidiary of INCA Energy, herein after referred to as INCA Energy) is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site south west of Swellendam, in the Western Cape Province. IE Swellendam Wind (Pty) Ltd has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Report consists of ten sections:

» **Chapter 1** provides background to the proposed wind energy facility project and the environmental impact assessment process.
» **Chapter 2** describes the project and alternatives.
» **Chapter 3** describes wind energy as a power generation option.
» **Chapter 4** outlines the regulatory and legal context of the EIA study.
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken.
» **Chapter 6** describes the existing biophysical and socio-economic environment
» **Chapter 7** describes the scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of environmental impacts associated with the proposed project.
» **Chapter 9** presents the conclusions of the impact assessment as well as an impact statement for the proposed project.
» **Chapter 10** contains a list of 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 ATTEND PUBLIC MEETING

You are cordially invited to attend a public meeting to discuss the proposed project as well as the key findings of the studies completed to date. The meeting is scheduled to take place as follows:

» **DATE:** 6 March 2013
» **TIME:** 17:00 - 18:30,
» **VENUE:** Swellendam Town Hall - Side Hall, Voortrek Street, Swellendam

INVITATION TO COMMENT ON THE DRAFT EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the Draft EIA Report which has been made available for public review and comment at the following locations from **20 February to 22 March 2013.**

» www.savannahsa.com
» Swellendam Public Library, 49 Voortrek Street, Swellendam, 6740
» Bedarsdorp Public Library, Church Street, Bedarsdorp, 7280

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
The due date for comments on the Draft Scoping Report is **22 March 2013**

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

SUMMARY

Background and Project Overview

IE Swellendam Wind (Pty) Ltd (a subsidiary of INCA Energy, herein after referred to as INCA Energy) is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Swellendam Local Municipality approximately 30 km south-west of Swellendam in the Western Cape Province. It is proposed for a cluster of up to 15 wind turbines (described as a wind energy facility or a wind farm), with a generating capacity of up to 45MW, to be constructed over an area of approximately 1 315 ha in extent. This facility is to be known as the **Goereesoe Wind Farm near Swellendam**.

Associated infrastructure proposed includes:

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal/ access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (maximum of 100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which lies on the south western boundary of the site, and crosses the north western corner of the site. Two options are being considered and assessed in the EIA.
  - Option A, adjacent to the north of the proposed turbine 1 (Length of proposed power line: 1400.3m).
  - Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line (Length of proposed power line: 23.6m).

The site for the proposed Goereesoe Wind Energy Facility falls within the Swellendam Local Municipality in the Western Cape Province. The broader area (1 315 ~ha in extent) includes

Portions 0, 2, 4 and 5 of Farm 432 [1]Goereesoe (refer to Figure 1):

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 EIA Study for the proposed Goereesoe Wind Farm south west of Swellendam in the Western Cape Province has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of GN R543, R544, R545 and R546 (18 June 2010), in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

Environmental Impact Assessment

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

A comprehensive public participation process is being undertaken in accordance with Regulation 54 of Government Notice No R543 of 2010 during the Scoping phase of this EIA process. This public participation process comprises the following:

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

1 Renosterhoek is the current name of the proposed farm. The 2011 cadastral dataset refer to the proposed farm names as Renosterhoek but the toposheets and titledeeds refers to the old name of Goereesoe from 1981.

Evaluation of the Proposed Project

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. This layout includes 13 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Mitigation to avoid impacts are primarily associated with the relocation of certain turbine positions of concern as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMP)** included within **Appendix P**.

The client has revised the layout to avoid areas of high sensitivity (refer to figure 3). This revised layout has 14 proposed turbines.

From the specialist investigations undertaken for the proposed Goereesoe Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 2 and A3 map in Appendix Q**). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» Remnants of ***Eastern Rûens Shale Renosterveld*** (including the constituent plant species and the habitat created by the plant communities) ***and Rûens Silcrete Renosterveld:*** This vegetation occurs mainly on the south-eastern section of the site. These are Critically Endangered vegetation types and are considered to be no go areas for development. **Turbines 6 & 7** should be relocated to areas on the site where this important vegetation type is not found. Cables and roads should also avoid areas of Endangered Rûens Silcrete Renosterveld.

» ***Bats sensitive areas*** - At least one of the species identified as potentially occurring in the area of the study site is listed as Vulnerable (*Cleotis percivali)* and three as Near Threatened (*Eidolon helvum, Miniopterus natalensis* and *Rhinolophus swinnyi*). The proposed turbine placements must be critically revised with the key objectives of moving the Turbines located in area of High Bat Sensitivity (i.e. **turbines 1, 3 and 8**) to an alternative location outside of

high sensitivity areas. Turbines located in the areas of Moderate Bat Sensitivity (i.e. turbines 11, 12 and 13) should preferably be moved to alternative locations. If this is not possible due to other constraints, these turbines must at least be prioritized in post-construction monitoring and implementation of mitigation measures.

» ***Heritage artefacts*** – Turbine 6 will impact on LSA sites. This turbine position may be moved away from the koppie and further into the field in order to avoid these sites. The full extent of the archaeological site at this location needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient but the full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape. Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required. No graves were observed in the study area, but if any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.

» ***Noise sensitive developers*** do occur in and around the site. The relocation of **turbine 03** further away from receptor **NSD03** will reduce the noise impact significance from a ***medium*** to a ***low*** at this receptor. The developer has indicated that they may remove **turbine 02** rather than turbine 03 (second turbine in proximity to **NSD03**). This option will also reduce the significance of a noise impact to a ***low*** at the receptor. It is deemed sufficient to remove either turbine, and therefore no further investigations or calculations will be conducted.

Final turbine positioning and placement of associated infrastructure should take cognisance of sensitive areas (as indicated on Figure 9.2). Should mitigation measures in the EMP be adhered to, impacts on the identified sensitive areas can be adequately managed.

Revised layout

In terms of this revised layout, the following changes have been made (Refer to figure 3):

1. Turbines 6 and 7 and the associated road infrastructure should be shifted to locations outside of the Critically Endangered Rûens Silcrete Renosterveld. **Turbine 6 and 7 have been relocated outside of no- go areas.**
2. Alternative access and cable routes to the proposed sites for Turbines 8 – 10 must be considered. It must be

ensured that there is no impact on Rûens Silcrete Renosterveld. **Existing roads in this area will be utilised. These roads will be improved for construction.**

3. The proposed turbine placements must be critically revised with the key objectives of moving the turbines located in area of High Bat Sensitivity, i.e. turbines 1, 3 and 8. **The developer has agreed to move these turbines should this be required, based on the outcome of the 12 Month bat monitoring.**
4. Turbines located in the areas of Moderate Bat Sensitivity (i.e. 11, 12 and 13) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritized in post-construction monitoring and implementation of mitigation. These turbines will be prioritised in the monitoring programme as recommended.
5. The relocation of turbine 3 in close proximity to noise sensitive development should be considered to minimise the noise impact. **This turbine is located outside the 500 m buffer area and is considered possible to implement operation mitigation to minimise noise impacts.**
6. Turbine 6 may relocated away from the koppie and further into the field from a heritage perspective. Alternatively, the site may be sampled by an archaeologist following the obtaining of a permit to destroy the site. **Turbine 6 has been relocated.**

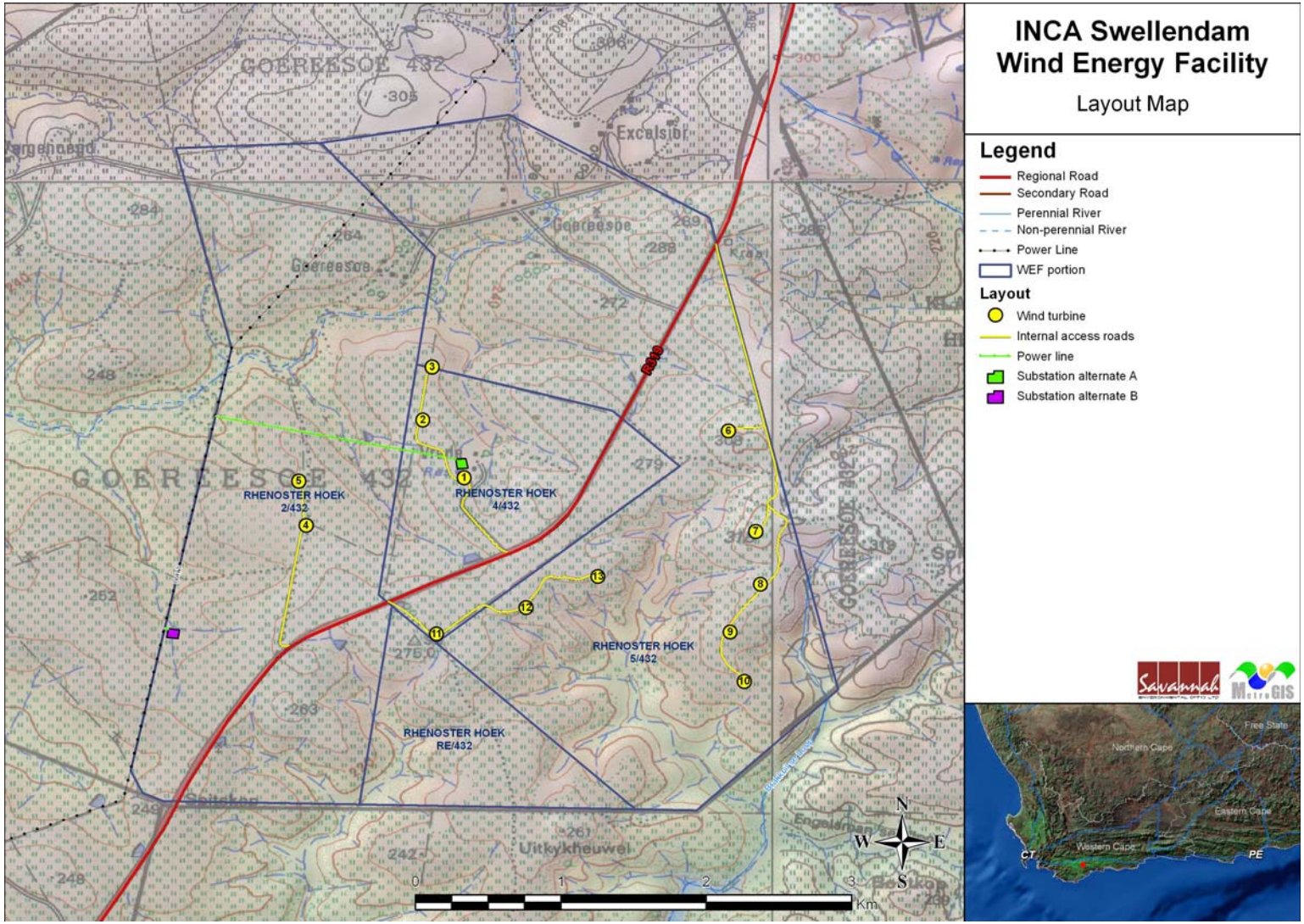

Figure 1: Locality map showing the study area for the establishment of the proposed Goereesoe Wind Farm, south west of Swellendam, in the Western Cape

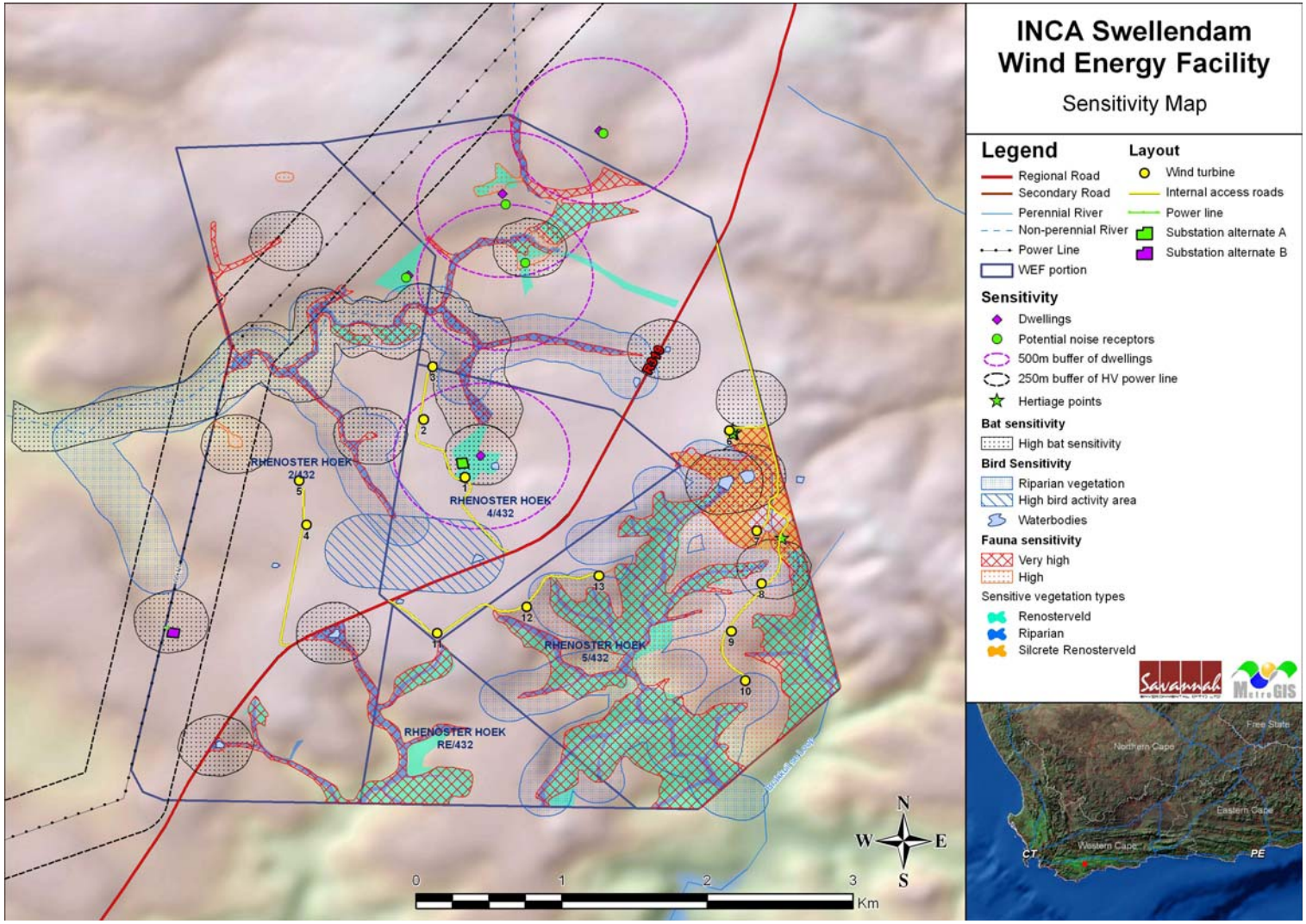

Figure 2: Environmental Sensitivity Map for the proposed Goereesoe Wind Farm, south west of Swellendam, in the Western Cape.

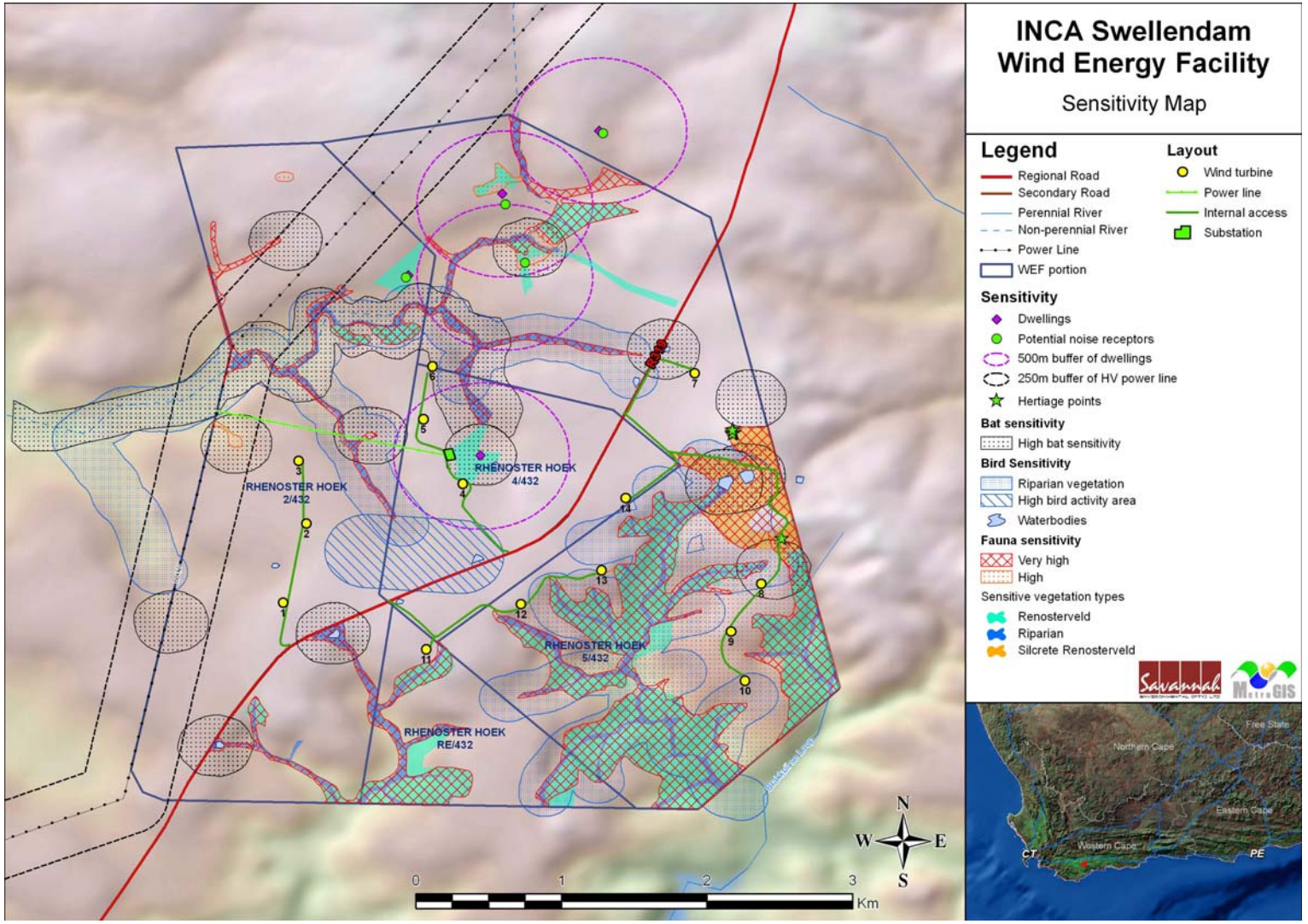

Figure 3: Environmental Sensitivity Map indicating revised layout to avoid areas of high sensitivity

TABLE OF CONTENTS

PAGE

APPENDICES

DEFINITIONS AND TERMINOLOGY

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

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

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
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
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
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
WC DEA&DP	Western Cape Department of Environmental Affairs and Development Planning

INTRODUCTION CHAPTER 1

IE Swellendam Wind (Pty) Ltd (a subsidiary of INCA Energy, herein after referred to as INCA Energy) is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Swellendam Local Municipality approximately 30 km south-west of Swellendam in the Western Cape Province. It is proposed for a cluster of up to 15 wind turbines (described as a wind energy facility or a wind farm), with a generating capacity of up to 45MW, to be constructed over an area of approximately 1 315 ha in extent. This facility is to be known as the **Goereesoe Wind Farm near Swellendam**.

The nature and extent of the Goereesoe Wind Energy Facility, as well as potential environmental impacts associated with the construction and operation of a facility of this nature are assessed in this Draft Environmental Impact Assessment (EIA) Report. This EIA Report consists of the following sections:

» **Chapter 1** provides background to the proposed wind energy facility project and the environmental impact assessment process.
» **Chapter 2** describes the project and alternatives.
» **Chapter 3** describes wind energy as a power generation option.
» **Chapter 4** outlines the regulatory and legal context of the EIA study.
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken.
» **Chapter 6** describes the existing biophysical and socio-economic environment
» **Chapter 7** describes the scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of environmental impacts associated with the proposed project.
» **Chapter 9** presents the conclusions of the impact assessment as well as an impact statement for the proposed project.
» **Chapter 10** contains a list of references for the EIA report and specialist reports.

1.1. Project Location

The site for the proposed Goereesoe Wind Energy Facility falls within the Swellendam Local Municipality in the Western Cape Province. The broader area

(1 315 ~ha in extent) includes Portions 0, 2, 4 and 5 of Farm 432 [2]Goereesoe (refer to Figure 1.1):

2 Renosterhoek is the current name of the proposed farm. The 2011 cadastral dataset refer to the proposed farm names as Renosterhoek but the toposheets and titledeeds refers to the old name of Goereesoe from 1981.

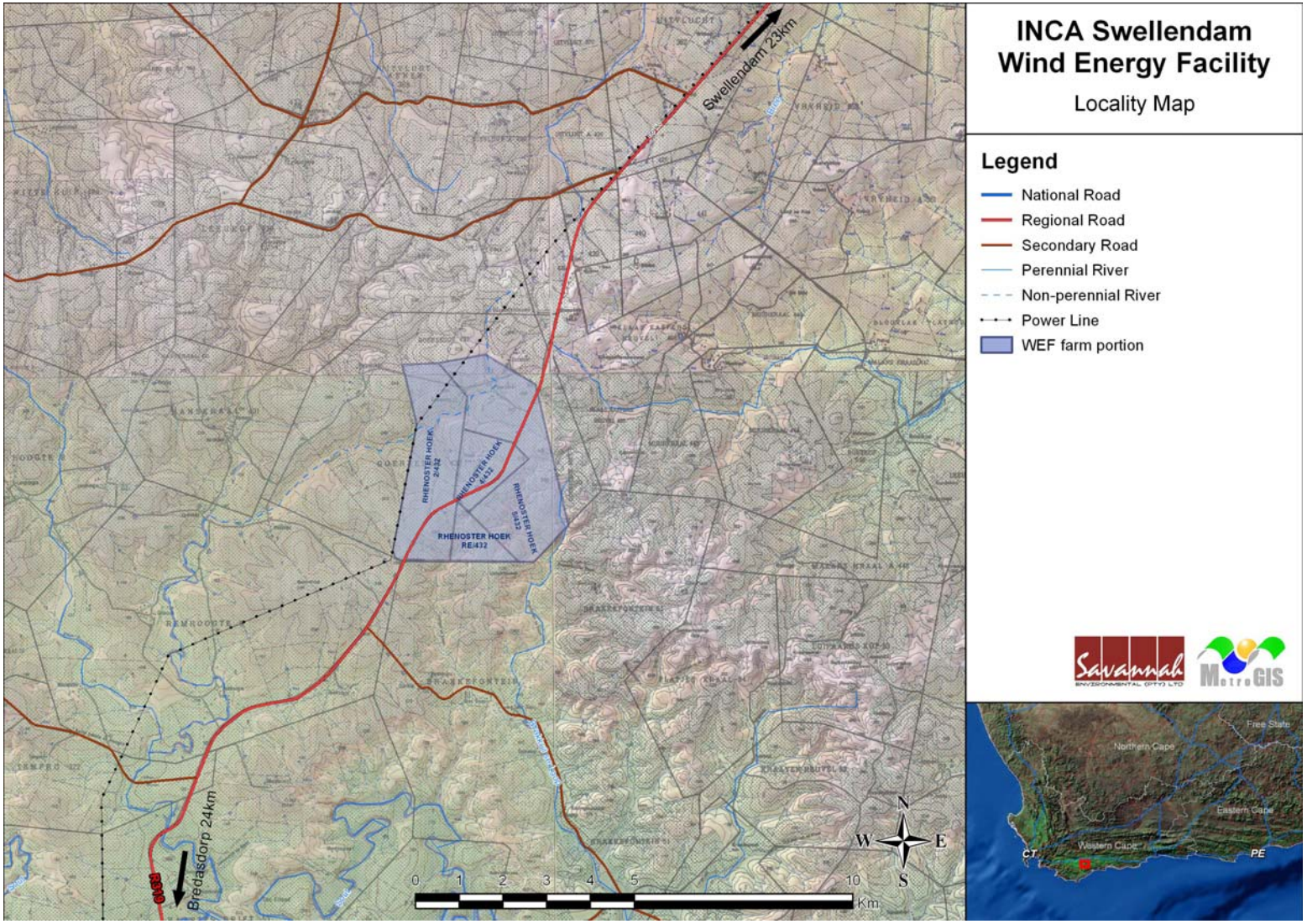

Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Goereesoe Wind Energy Facility, Western Cape Province

1.2. Overview of the Proposed Project

Wind turbines use the energy from the wind to generate electricity. In essence, the blades of the turbine are turned by the wind and the energy captured is converted into electrical energy and supplied to the electricity grid for use in homes and elsewhere.

INCA Energy will be considering various wind turbine technologies in order to maximise the capacity of the site. The turbines being considered will each have a capacity of up to 3 MW. The turbines will have a hub height of up to 110m, and a rotor diameter of up to 112m. The worst case scenario, i.e. a wind turbine up to 3MW in capacity, has been considered in the EIA. Up to 15 wind turbines are proposed to be constructed on the site. Associated infrastructure which is required for such a facility includes, inter alia:

» Concrete foundations to support the turbines.
» Cabling between the turbines, to be laid underground where practical.
» An on-site substation to facilitate the connection between the wind farm and the electricity grid. Two options are being considered:
  - Option A, adjacent to the north of the proposed turbine 1.
  - Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which crosses the north-west corner of the site.
» Internal access roads to each turbine.
» Workshop area / office for control, maintenance and storage.

The capacity of the proposed Goereesoe wind energy facility will depend on the most suitable wind turbine (in terms of the turbine capacity) selected by INCA Energy. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 45MW.

Specialist software is available to assist developers in selecting the optimum position for each turbine before the project is constructed. This layout also informs the positioning of other infrastructure such as access roads and substation/s. The positioning or detailed layout of the wind energy facility has been developed by INCA Energy and is shown in **Figure 1.2**. This is the layout assessed in this EIA. Final placement of infrastructure will be informed by the outcomes of the EIA as well as from the results of the on-site wind monitoring.

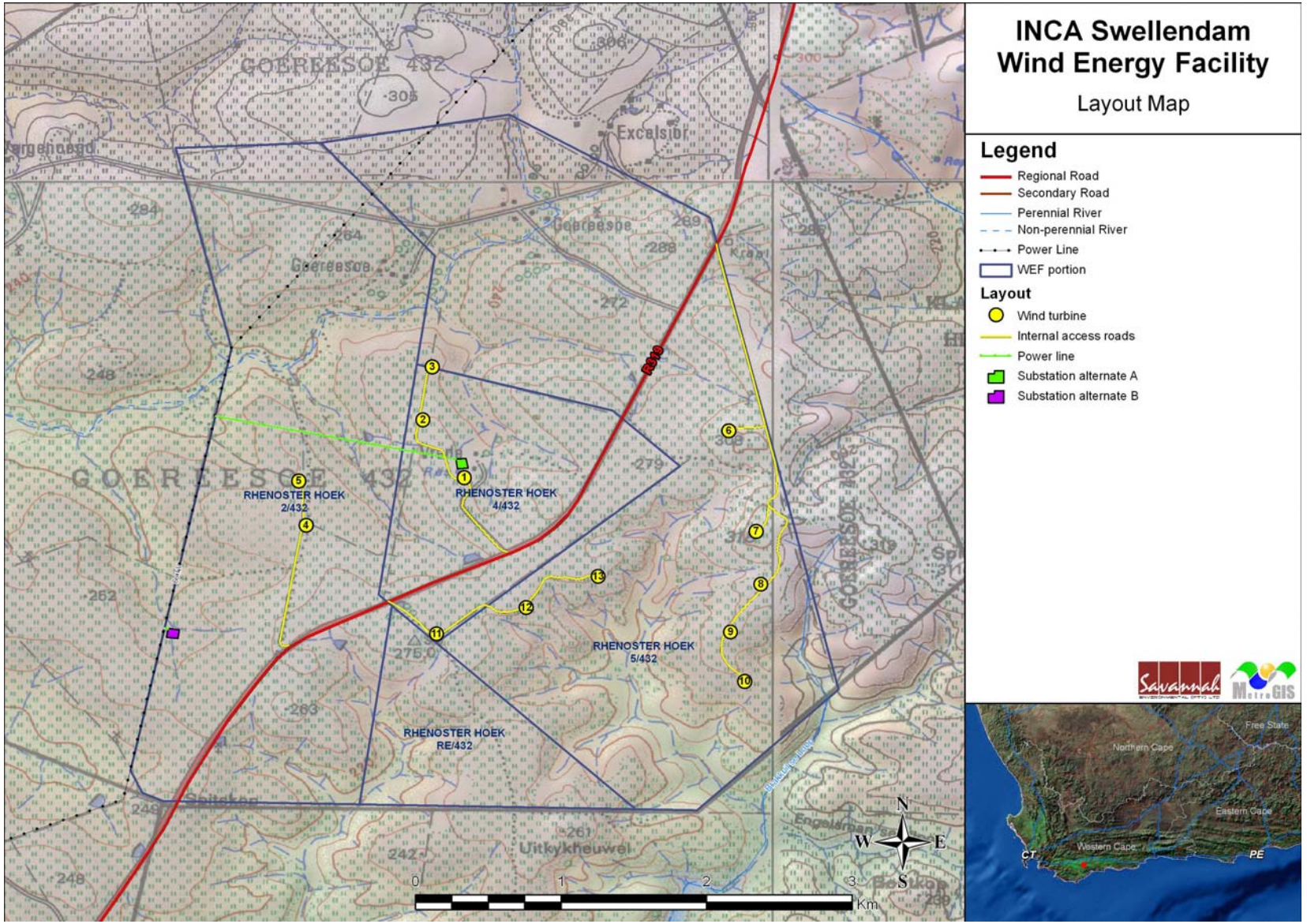

Figure 1.2: Layout map showing the technical design and layout of the Goereesoe Wind Energy Facility, Western Cape Province

1.3. Environmental Sensitivities Identified during the Scoping Phase

A scoping study was conducted for the project and completed in March 2012 and accepted by DEA in July 2012. The scoping report identified areas of potential environmental sensitivity to inform the design of the wind energy facility and for further investigation during the EIA phase. These sensitive areas are shown in **Figure 1.3** and include:

» Areas of visual exposure within (but not restricted to) 10 km of the proposed wind energy facility site, and include sensitive receptors such as homesteads and observers travelling along major and gravel roads,
» Potentially sensitive noise receptors,
» Areas of wetlands and watercourse sensitivity,
» Areas of flora/fauna sensitivity, and
» Areas of Agricultural sensitivity.

The majority of potential impacts identified to be associated with the construction and operation of the proposed wind farm are anticipated to be localised and restricted to the proposed site. No environmental fatal flaws were identified to be associated with the site at this stage in the process. However, areas of potential sensitivity were identified through the scoping phase.

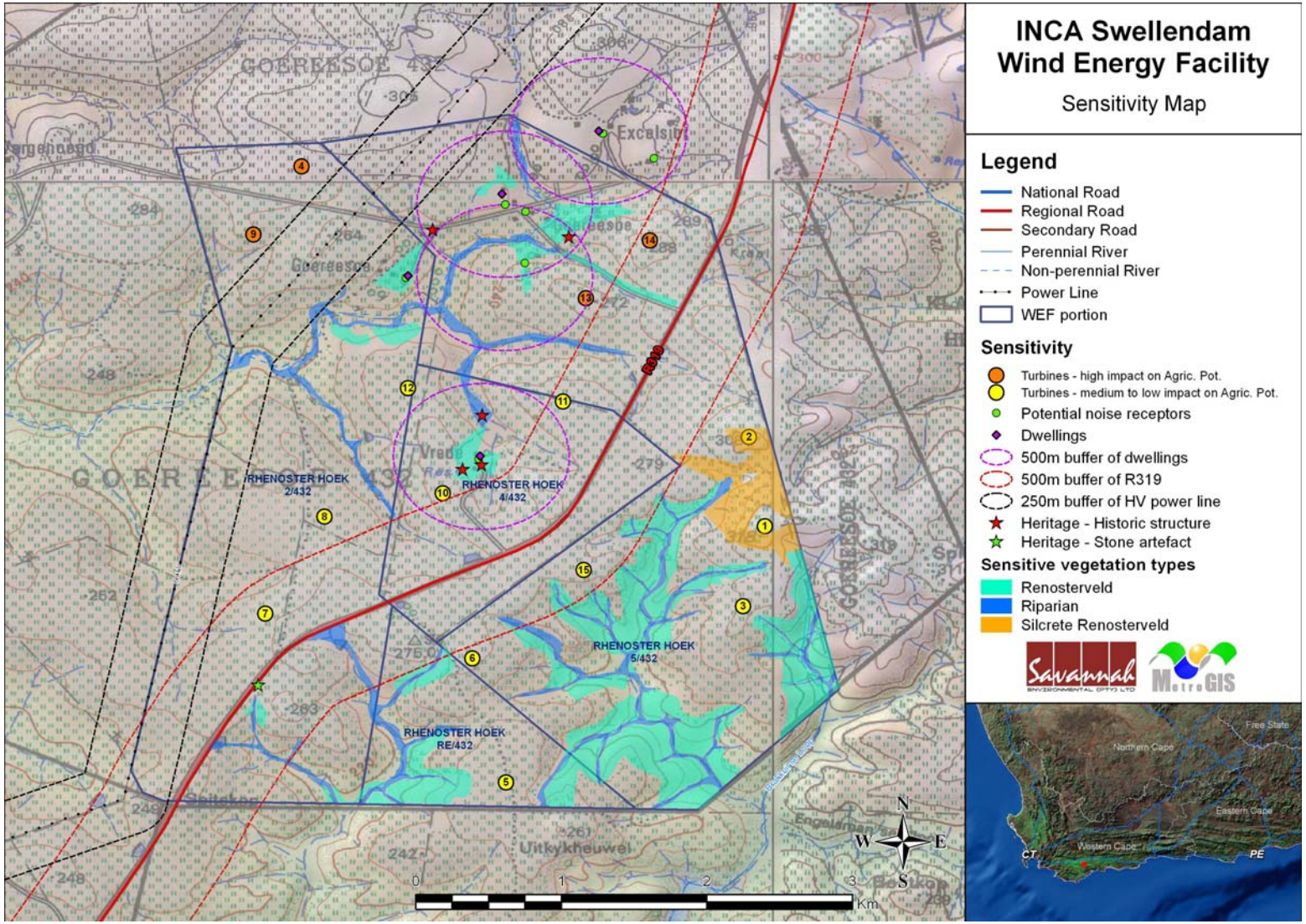

Figure 1.3: Scoping study desktop environmental sensitivity map for the proposed Goereesoe Wind Energy Facility (Please note that the proposed layout has since been revised since the scoping phase- refer to figure 1.2 above for revised layout investigated through the impact assessment phase)

The scoping phase sensitivity map provides a rough scale estimate of sensitivity on the site, and these areas were subject to survey and ground-truthing during the EIA phase of the project. Based on the scoping environmental sensitivity map (Figure 1.3) it was recommended that areas of high environmental sensitivity should be avoided, while areas of medium and low environmental sensitivity could be considered for the location of the wind turbines and associated infrastructure.

The components of the proposed Goereesoe Wind Energy Facility, (for the construction, operation and decommissioning phases) are discussed in more detail in Chapter 7.

1.4. Requirement for an Environmental Impact Assessment Process

The proposed project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) of June 2010 published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations of June 2010 and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as “listed activities”. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by the DEA (under Application Reference number: 12/12/20/2199). Through the decision-making process, the DEA will be supported by the Western Cape Department of Environment Affairs and Development Planning (Western Cape DEA&DP), as the commenting authority for the project.

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. INCA Energy has appointed Savannah Environmental (Pty) Ltd to conduct the independent Environmental Impact Assessment (EIA) process for the proposed project.

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

In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010). The application for authorisation has been made for the following listed activities:

Government Notice	Activity No	Description of listed activity	Applicability to the Project
GN544	10	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 kV but less than 275 kV; or ~~*(ii)* Inside urban areas or industrial complexes with a capacity of 275 kV or more.~~	An overhead power line (66kV) is likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which crosses the north west corner of the site
GN544	11	The construction of: ~~(i) Canals;~~ ~~(ii) Channels;~~ ~~(iii) Bridges;~~ ~~(iv) Dams;~~ ~~(v) Weirs;~~ ~~(vi) Bulk stormwater outlet structures;~~ ~~(vii) Marinas;~~ ~~(viii) Jetties exceeding 50 m^2 in size~~ ~~(ix) Slipways exceeding 50 m^2 in size~~ (x) Buildings exceeding 50 m^2 in size; or (xi) Infrastructure or structures covering 50 m^2 or more.	The proposed facility may impact on drainage lines or other watercourses. ~~The applicability of this activity is to be confirmed at EIA stage.~~

Government Notice	Activity No	Description of listed activity	Applicability to the Project
		Where such construction occurs within a watercourse or within 32 m of a watercourse, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	
GN544	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 m^3.	The onsite storage of diesel and fuel in containers for construction machinery and vehicles. ~~Applicability to be confirmed at EIA stage.~~
GN544	22	The construction of a road, outside urban areas, *(i)* With a reserve wider than 13.5 m; *(ii)* Where no road reserve exists where the road is wider than 8 m; or *(iii)* For which an environmental authorisation was obtained for the route determination in terms of Activity 5 of Government Notice 387 of 2006 or Activity 18 of Notice 545 of 2010.	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 13 m in width.
GN544	26	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Two turbines fall within CBAs, but a revised layout is advised to avoid these sensitive areas.
GN544	47	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – *(i)* Where the existing road reserve is wider than 13.5 m; or	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 13 m in width.

Government Notice	Activity No	Description of listed activity	Applicability to the Project
		(ii) Where no reserve exists, where the existing road is wider than 8 m – *(iii)* Excluding widening or lengthening occurring inside urban areas.	
GN545	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 MW or more.	INCA Energy is proposing the establishment of a wind farm up to 45 MW.
GN545	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; Except where such physical alteration takes place for: *(i)* Linear development activities; or *(ii)* Agriculture or afforestation where activity 16 in this schedule will apply.	The facility is proposed to be established within an area of ~1 315 ha in extent.
~~GN546~~	~~3~~	~~The construction of masts or towers of any material or type used for telecommunication broadcasting or radio transmission purposes where the mast:~~ ~~(i) Is to be placed on a site not previously used for this purpose; or~~ ~~(ii) Will exceed 15 m in height, but excluding attachments to existing buildings and masts on rooftops.~~ ~~(d) In Western Cape:~~ ~~*(i)* In an estuary;~~ ~~*(ii)* All areas outside urban~~	~~Applicability to be confirmed at EIA stage.~~

Government Notice	Activity No	Description of listed activity	Applicability to the Project
		~~areas; or~~ ~~*(iii)* Areas inside urban areas but outside commercial and industrial areas.~~	
GN546	4	The construction of a road wider than 4 m with a reserve less than 13,5m. <u>(d) In Western Cape:</u> (ii) all areas outside urban areas.	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 13 m in width.

This report documents the assessment of the potential environmental impacts of the proposed construction and operation of INCA Energy. This study concludes the EIA process and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.5. Objectives of the Environmental Impact Assessment Process

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

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

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

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

Savannah Environmental was contracted by INCA Energy as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to INCA Energy. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The 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.

The Environmental Assessment Practitioners (EAPs) from Savannah Environmental who are responsible for this project are:

» Jo-Anne Thomas, the principle EAP for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 14 years of consulting experience in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.
» Alicia Govender, the principle author of this report, holds an Honours Bachelor of Science degree in Environmental Management and has 5 years of experience in environmental management. She is currently the responsible EAP for several renewable energy projects and other EIAs across the country.

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:

Specialist	Area of Expertise
Simon Todd of Simon Todd Consulting	Terrestrial Fauna and ecology
Dave McDonald of Bergwind Botanical Surveys and Tours	Flora and ecology
Barbara Monteiro and Riccardo Ramahlo of Bio3	Avifauna
Kath Potgieter of Endangered Wildlife Trust	Bats
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping
Stefan de Kock of Perception Heritage Planning and Tim hart of ACO Associates	Heritage
Tony Barbour Environmental Consulting and Research	Social
Francois Knight of Agri Informatics	Agricultural potential
Morne de Jager of M2 Environmental Connections CC	Noise
Piet Arangie of ITS Engineers	Transportation study

The curricula vitae for EAPs from Savannah Environmental as well as the specialist consultant's team are included in **Appendix A**.

PROJECT DESCRIPTION CHAPTER 2

The site identified for consideration of the Goereesoe Wind Energy Facility is located within the Swellendam Local Municipality in the Western Cape Province, and lies approximately 30 km south-west of Swellendam. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 45 MW and will comprise of the following infrastructure:

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal/ access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which crosses the north-west corner of the site. Two options are being considered and assessed in the EIA.

The technical design and layout of the wind energy facility is illustrated in Figure 2.1. **Appendix P** contains A3 maps showing the detail of the layout of the facility.

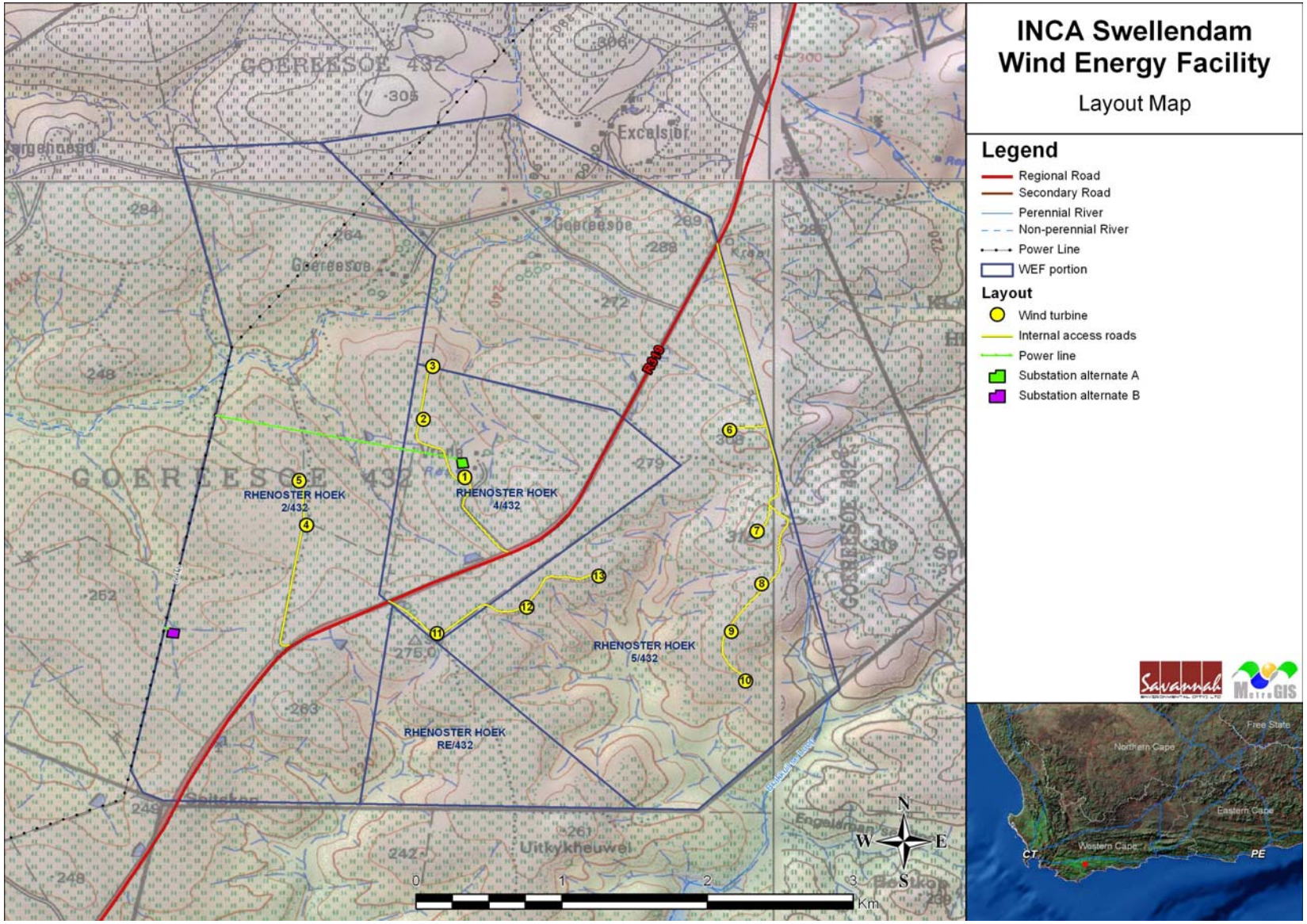

Figure 2.1: Layout map showing the technical design and layout of the Goereesoe Wind Energy Facility and associated infrastructure

2.1 The Need and Desirability of the Proposed Project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. The main objectives of the Swellendam Local Municipality IDP and SDF are summarised below.

a) Swellendam Local Municipality Integrated Development Plan (IDP) (2012-2017)

The Swellendam 2012-2017 Draft IDP is the first IDP of the new, third 5-year IDP cycle. The document also includes a Municipal Turnaround Strategy in response to noted issues concerning low administrative capacity, a well-defined personnel skills problem in some areas, and major backlogs in infrastructure development and maintenance, linked to financial constraints. The 2012-2017 IDP is explicitly aligned with the 12 National Outcomes (2010), the National Development Plan (2011), the National Spatial Development Perspective (2006) and the Western Cape Draft Strategic Plan (2011).

Key objectives of the SLM outlined in the 2012-2017 IDP include:

» Provision of a sound economic basis as well as a quality environment by practicing sustainable planning and thus promoting the creation of jobs and the expansion of tourism;
» Provision of a healthy and safe living environment;
» Empower the SLM population by the provision of / and exposure to the necessary training facilities, academic as well as practical skills development;
» Protecting and preserving the natural environment in harmony with future town development;
» Correcting spatial imbalances;
» Combating poverty and unemployment;
» Development of integrated and sustainable settlements (SLM, 2012: 26-27).

b) Swellendam Local Municipality Spatial Development Framework (2009)

The Swellendam Spatial Development Framework (SDF) was finalized in 2008, and approved by Council in June 2009. The SDF has been submitted to DEA&DP

for approval as structure plan in terms of LUPO, but approval is pending. Indications are that the SDF urban plans for Infanta (the SLM's only coastal area) may need to be updated in line with the pending outcome of the ODM/ WCP coastal setback line determination processes.

The main objective of the SDF is to create a spatially based policy framework whereby growth in the SLM may be managed positively, and to the benefit of all. The plans contained in the SDF focus on how land is to be used efficiently and sustainably within the broader context of protecting its natural resources, historic value and developing the tourist potential of the SLM. In doing so, the SDF makes policy, land use and development planning proposals for specific land portions to assist decision-making with regard to spatially related development matters for the next 5 to 10 years (i.e. until 2019).

The SDF lists a number of key environmental considerations that apply to all future planning actions in the SLM area, therefore also relevant to the study. These are:

» Protection of areas of high irreplaceable value in terms of meeting targets for biodiversity conservation, areas important for the maintenance of ecological and evolutionary processes, areas critical to the provision of ecological services and special habitats;
» Integration of the river systems (Klippe, Buffeljagts, Huis, Koornlands, Breede) and coastline (Infanta) as ecological corridors into the regional open space system;
» Integration of the mountain ranges (Langeberg, Potberg, Warmwatersberg) into the regional open space system;
» Desirable land use and development to retain the natural and cultural/historical landscapes that are of considerable significance.

c) Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, the developer considers the Goereesoe project to be financially viable. The "need and desirability" of the local community as reflected in the IDP and SDF for the area is also considered in the EIA. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP and SDF). Although the renewable energy sector is not explicitly identified as a sector or initiative in the current municipal policy and planning documents as outlined above, it could contribute positively to the needs on the local community, including development, social services, education and employment opportunities in this area. The project will create employment and business opportunities during the construction and operational phases, as well as the opportunity for

skills development for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

In addition, the development of the project would benefit the local/regional/national community by developing a renewable energy project which would reduce the country's dependence on fossil-fuel generated electricity. In addition, according to Department of Energy (DoE) bidding requirements, the developer must plan for a percentage of the profit per annum from the wind energy facility to go back into the community through a social beneficiation scheme.

d) National Requirement for Renewable Energy Projects

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, INCA Energy proposes the establishment of the Goereesoe Wind Energy Facility to add new capacity to the national electricity grid.

e) The Desirability for the Goereesoe Wind Energy Facility Project

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while affecting the smallest land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed Goereesoe Wind Energy Facility is located in an area considered to be highly desirable for wind energy generation

based on the average wind speeds recorded. The proposed site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), suitable proximity in relation to the existing electricity grid, ease of access, land availability and minimum technical constraints from a construction and technical point of view as well as after testing of wind resource with wind masts. INCA Energy considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development. Wind monitoring is currently being undertaken on site using a wind monitoring mast in order to confirm the wind resource on the site, and ultimately inform the layout of the facility as well as the turbine selection process.

Most of the proposed area is currently classified as 'Vacant' or 'Unspecified', the site investigation of the specialists however identified dryland agriculture (winter crops – grains and seed-oil). The Goereesoe Farms are typical of most of the farms in the region where as much land as possible has been transformed from the natural renosterveld to grain-fields. Only areas on particularly steep terrain or where the soil is not at all suitable for cultivation have not been ploughed. Areas unsuitable for agriculture are used for running livestock, both sheep and cattle. The development of the wind energy facility will allow continued crop production on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure and as such would not result in a significant loss of agricultural land. Therefore the current land-use will be retained, while also generating renewable energy from the wind. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property.

f) How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through compliance with the requirements of the relevant legislation in undertaking the assessment of potential impacts, as well as through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner and all effort has been made to involve all relevant interested and affected parties, stakeholders

and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

2.2 Technology Alternatives

It is the intention of INCA Energy to develop renewable energy projects, and therefore only renewable energy technologies were considered in the project development phase. Based on the characteristics of the proposed development site and local climatic conditions, it was determined by INCA Energy that the site would be most suitable for development of a wind energy facility, and not for any other renewable energy technologies. Through the project development process, INCA Energy is considering various wind turbine options in order to maximise the capacity of the site. It is anticipated that the turbines to be utilised for the proposed Goereesoe Wind Energy Facility will have a hub height of up to 110m, and rotor diameter of 112 m, with a capacity of up to 3MW. The technology provider has however not yet been confirmed, and will only be selected after further wind analysis as well as a competitive tendering process.

2.3 Site-specific or Layout Design Alternatives

A wind turbine layout has been undertaken to effectively 'design' the wind energy facility. Through the process of determining constraining factors and environmentally sensitive areas during the scoping phase, the layout of the wind turbines and infrastructure has been developed by INCA Energy (refer to layout as shown in **Figure 2.1**.). The layout considered in the scoping was an alternative layout considered. The revised layout is considered to be an 80% accurate layout, and allows for some adjustment to avoid any site-specific environmental constraints identified through the EIA phase, where necessary. The overall aim of the layout is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. This micro-siting information has informed the specialist impact assessments in this EIA phase. The planning process also included the positioning of other ancillary infrastructure, including, the power line, the internal substation site and access roads.

The following layout alternatives have been proposed for consideration within the EIA:

» Two alternative substation sites:
  * Option A, adjacent to the north of the proposed turbine 1.
  * Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line.
» Two alternative power line routes, i.e. a power line route between each of the on-site substation options and Vryheid-Bredasdorp 66kV power line.
  * Option A: Power line route from substation A (Length:1400.3 m)
  * Option B, Power line route from substation B (Length:23.6 m)

Both alternatives fall within the proposed site under investigation. The 66 kV power line will have a servitude of up to 22m wide.

These layout alternatives are shown in **Figure 2.1**, are described below, and assessed in Chapter 8.

2.4 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Goereesoe Wind Energy Facility on the proposed site. In this scenario the potential environmental and social impacts will not occur and the status quo will be maintained. This alternative is assessed within Chapter 8 of this report.

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while affecting the smallest land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The power generated from the Goereesoe Wind Energy Facility will be up to 45MW, at a commercial scale to feed into the Eskom grid.

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

3.1 The Importance of the Wind Resource for Energy Generation

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

» **Wind speed** is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this

determines the cost of generating electricity. The doubling of wind speed increases the wind power by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating at wind speeds of between ~3 m/s to 4 m/s, with wind average speeds greater than 6 m/s currently required for a wind energy facility to be economically viable. Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography influences the flow of air, and results in turbulence within the air stream, and this has to be considered in the placement of turbines.

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

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

A wind resource measurement and analysis programme [3]must be conducted for the site proposed for development, as only measured data will provide a robust prediction of the facility's expected energy production over its lifetime.

The placement of the individual turbines within a wind energy facility must consider the following technical factors:

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

Wind turbines typically need to be spaced approximately 3 to 8 times the rotor diameter apart in order to minimise the induced wake effect the turbines might have on each other. Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria) the spacing requirements can be considered through the process of micro-siting the turbines on the site.

3.2 What is a Wind Turbine and How Does It Work

[3] IE Swellendam has almost 2 years of wind data from a 80m wind mast

The kinetic energy of wind is used to turn a wind turbine to generate electricity. A wind turbine typically consists of **three rotor blades** and a **nacelle** mounted at the top of a tapered **tower**. The mechanical power generated by the rotation of the blades is transmitted to the generator within the nacelle via a gearbox and drive train.

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed Goereesoe Wind Energy Facility in the Western Cape Province will have a hub height of up to 110 m, and rotor diameter of 112 m. These turbines would be capable of generating in the order of up to 3 MW each (in optimal wind conditions).

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components (refer to Figure 3.1):

» The foundation
» The tower
» The rotor
» The nacelle

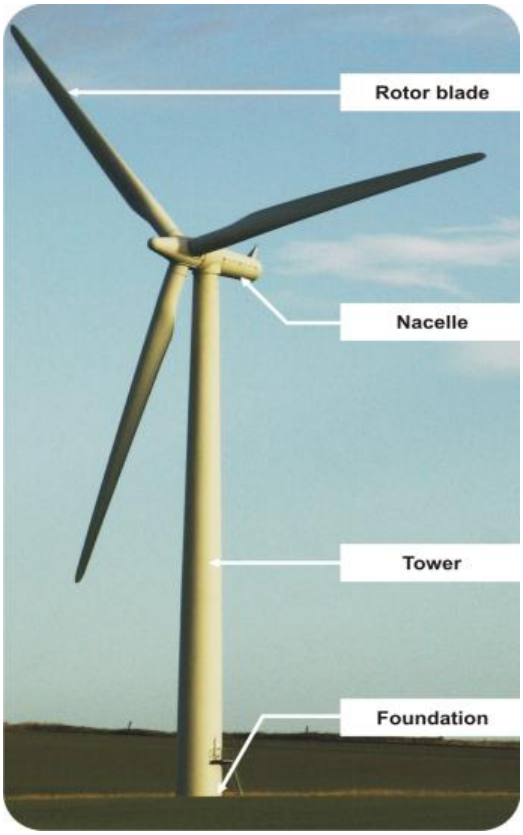

Figure 3.1: Illustration of the main components of a wind turbine

The foundation

The foundation is used to secure each wind turbine to the ground. These structures are commonly made of concrete and are designed for vertical loads (weight) and lateral loads (wind).

The tower

The tower, which supports the rotor, is constructed from tubular steel or concrete. The towers planned to be used for this project are up to 110m in height. The nacelle and the rotor are attached to the top of the tower.

The tower is part of the overall wind turbine 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.

The rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades, typically made from fibreglass materials or carbon fibre reinforced plastics. When a rotor blade is in contact with wind, the airflow is deflected, airflow over the top arched edge has to take a longer path than at the relatively straight underside. This results in a low pressure at the upper side and a high pressure at the lower side. The pressure differential causes the blades to start moving. The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

The nacelle (geared)

The nacelle at the top of the tower accommodates the gears, the generator, anemometer for monitoring the wind speed and direction, cooling and electronic control devices, and yaw mechanism. Geared nacelles generally have a longer form than a gearless turbine.

3.2.2. Operating Characteristics of a Wind Turbine

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

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 3 m/s and 4 m/s.

At very high wind speeds, typically over 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.

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

The need to expand electricity generation capacity in South Africa is based on **national policy** and informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in **Figure 4.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the proposed wind energy facility development.

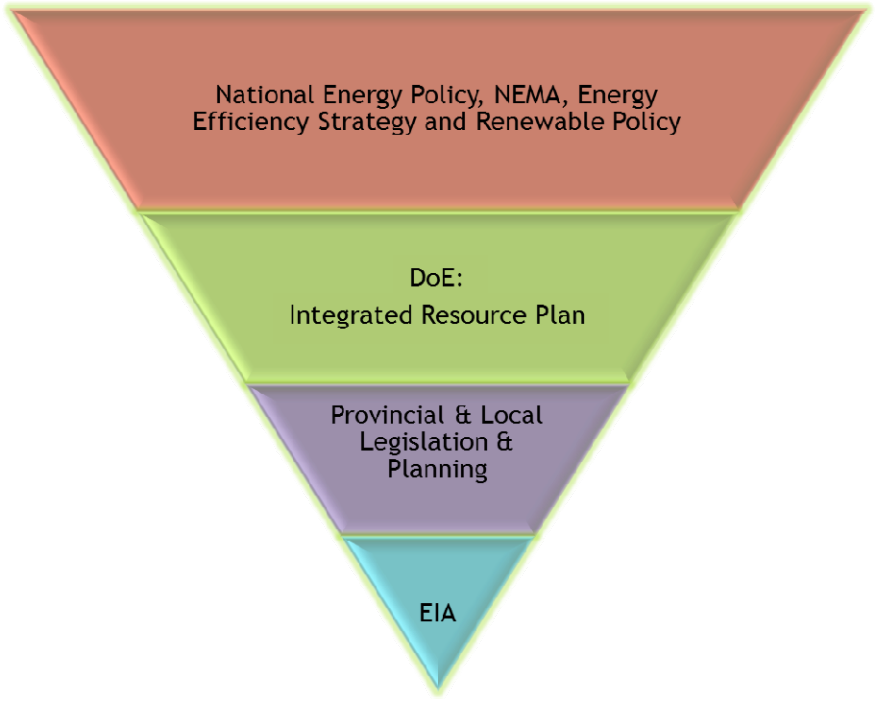

Figure 4.1: Hierarchy of electricity policy and planning documents

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

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by the 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- and long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and ***wind*** and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

4.1.2 Renewable Energy Policy in South Africa, 1998

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

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

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

4.1.3 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.

4.1.4 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.

4.2. Regulatory Hierarchy for Energy Generation Projects

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

At **National Level**, the main regulatory agencies are:

» *Department of Energy (DOE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). Wind energy is considered under the White Paper for Renewable Energy (2003) and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provide legislative protection for listed or proclaimed sites.
» *South African Civil Aviation Authority (SACAA):* This Department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *South African National Roads Agency (SANRAL):* This agency of the Department of Transport is responsible for all National road routes.
» *Department of Water Affairs (DWA):* This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development.
» *Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department

has published a guideline for the development of wind farms on agricultural land.

» *Department of Mineral Resources:* Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resources that might occur on site.

At **Provincial Level**, the main regulatory agencies are:

» *Provincial Government of the Western Cape – Department of Environmental Affairs and Development Planning (DEA&DP):* This department is the commenting authority for this project.
» *Department of Transport and Public Works (Western Cape):* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *CapeNature:* This Department's involvement relates specifically to the biodiversity and ecological aspects of the proposed development activities on the receiving environment to ensure that developments do not compromise the biodiversity value of an area. The Department considers the significance of impacts specifically in threatened ecosystems as identified by the National Spatial Biodiversity Assessment or systematic biodiversity plans.
» *Department of Agriculture and Land Care:* This Department's involvement relates specifically to sustainable resource management and land care.
» *Heritage Western Cape:* Heritage Western Cape is a provincial heritage resources authority. This public entity seeks to identify, protect and conserve the rich and diverse heritage resources of the Western Cape.
» *Department of Water Affairs:* This Department is responsible for evaluating and issuing licenses pertaining to water use.

At a **Local Level**, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. The Swellendam Local Municipality was identified as having jurisdiction over the area in which the proposed facility is foreseen to be established. The Swellendam Local Municipality forms part of the Overberg District Municipality. Both of these municipalities have been consulted with throughout the EIA process.

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

and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.

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

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

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

Several Acts, standards, or guidelines have informed the project process and the scope of issues addressed and assessed in this EIA Report:

» National Environmental Management Act (Act No. 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 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)
  * Integrated Environmental Management Guideline Series 9 (Need And Desirability Guideline Document)
» Swellendam Local Municipality Integrated Development Plan (2012-2017)
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).
» Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: Guideline for Environmental Management Plans. 2005
» Provincial Government Western Cape, Department of Environmental Affairs and Development Planning (2002)
» Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa" (Jenkins *et al* 2012)
» South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments. Wildlife & Energy Programme of the Endangered Wildlife Trust (2011).

A review of legislative requirements applicable to the proposed project is provided in the table in Table 4.1.

Table 4.1: Relevant legislative permitting requirements applicable to the Goereesoe Wind Energy Facility Project EIA

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.	Hazardous Waste – National DEA General Waste – WC DEA&DP	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 No R55 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 Western Cape Province. Allows the Minister of Environmental Affairs to make regulations regarding noise, among	National Department of Environmental Affairs Provincial Environmental Department - commenting authority. Local Municipality	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix M). There are noise level limits which must be adhered to.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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. 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	A water use permits or licenses are required to be applied for or obtained, if infrastructure such as access roads or cabling cross watercourses, or for infrastructure within 500m of a wetland or watercourse (Section 21 c and i) . If ground or surface water is planned to be abstracted for use at the facility (either during construction or operation), this will also require a water use licence (Section 21 a and b).
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.
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	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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		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 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	» South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » Heritage Western Cape – Issue of permits for removal or destruction of heritage resources in the Western Cape.	A heritage impact assessment is required to be undertaken as part of the EIA process (refer to Appendix L).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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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. 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 heritage resource may be affected. 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.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened & protected species has been published in terms of S 56(1) -	National Department of Environmental Affairs	Specialist flora and fauna studies are required to be undertaken as part of the EIA process. A specialist fauna and flora assessment has been undertaken for the proposed project

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011). » This Act also regulates alien and invader species.		(refer to Appendix F and G respectively). A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. The developer has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the 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.	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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» 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 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.		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 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	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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	trained personnel for extinguishing fires.		
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 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.	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. Note that the site does not comprise of any protected tree species of natural forest.
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	Civil Aviation Authority (CAA)	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. An obstacle approval for the wind energy facility is required to be obtained from the CAA.

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

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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	Provincial Department of Environmental Affairs and Development Planning (DEA&DP) - Swellendam Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
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.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land.	Provincial Environmental Department - commenting authority. Local Municipality, District Municipality	Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			environmental authorization for the proposed project.
Provincial Policies / Legislation			
Western Cape Noise Control Regulations: PN 627 of 1998	The control of noise in the Western Cape Province is legislated in the form of Noise Control Regulations promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989.	Western Cape DEA&DP	In terms of Regulation 4 of the Noise Control Regulations: "No person shall make, produce or cause a disturbing noise (greater than 5 dBA), or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof".
Western Cape Land Use Planning Ordinance 15 of 1985	Details land subdivision and rezoning requirements and procedures	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Swellendam 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 appropriate zone will be required. It is anticipated that the wind energy development would require a rezoning to either Industrial Zone 14 or Special Zone5 as defined in the Scheme Regulations in terms of Section 8 of LUPO (Government Gazette,

[4] "Industry: means an enterprise defined in the regulations made in terms of Section 35 of the Machinery and Occupational Safety Act (Act 6 of 1983)" (note, these Regulations include any 'electrical installation')."

[5] "Special Usage: means a use which is such, or in respect of which the land use restrictions are such, that it is not catered for in these regulations, and which is set out in detail … by means of conditions of approval, or by means of conditions applicable to the special zone."

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			December 1988). Rezoning is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.
The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000	The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000) defines the protection status of plants as follows: * **''endangered flora''** means flora of any species which is in danger of extinction and is specified in Schedule 3 or Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include flora of any species specified in such Appendix and Schedule 4; (thus all Schedule 3 species) * **''protected flora''** means any species of flora specified in Schedule 4 or Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include any species of flora specified in such Appendix and Schedule 3 * **''indigenous unprotected flora''** means	Cape Nature	Removal / relocation of protected plant / animal species require a permit to be obtained from the Cape Nature

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	any species of indigenous flora not specified in Schedule 3 or 4;		
Local Legislation / Policies / Plans			
Swellendam Local Municipality Integrated Development Plan (IDP) 2012-2017	Provides the overarching strategic framework for the sustainable long-term management of the municipality	Swellendam Local Municipality.	New developments in the municipality to be in line with the IDP.
Western Cape Transportation Amendment Act of 1996	The provincial MEC may grant permit to undertake works within 200m of the published route upon receipt of the report assessing the potential impacts thereof.	Western Cape Department of Public Transport and Community Liaison	Any application for authorisation contemplated in the ECA and NEMA in respect of a 200m area on either side of a published route determination for a provincial road must be accompanied by a report that addresses the issues listed in that section of the Act.
Standards/ Guidelines			
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'.	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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» 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.		
Draft Guidelines For The Evaluation And Review Of Applications Pertaining To Wind Farming On Agricultural Land (September 2010)	This document provides an outline of the type of agricultural / soil study required for wind farms and for submission to DAFF.	National Department of Agriculture	Requirements for soils and agricultural potential assessments to inform decisions regarding layouts affecting agricultural land and food security.
The Equator Principles (June 2003)	The Equator principles is benchmark in the financing of projects, which deals with determining, assessing and managing social and environmental risks related to the financing of projects, such as wind energy facilities.	International Finance Corporation (IFC) and World Bank	A wind energy facility is considered a Category B project
Environmental, Health, and Safety (EH&S) Guidelines for Wind Energy (2007)	The EH&S Guidelines for wind energy developments are technical reference documents with general and wind energy specific examples of Good International Industry Practice.	International Finance Corporation (IFC) and World Bank	This document was developed to guide the development of wind projects (which intend on applying for WB/IFC funding). Broad recommendations for management of

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			environmental, health and safety impacts of wing energy facilities are provided in this document, which developers who intend on applying for finance must consider.
Regional Methodology for Wind Energy Site Selection: a Guideline Document prepared by DEA&DP	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) for the Western Cape	DEA&DP	Developers can use the guideline document as a tool for siting of wind energy facilities in the Western Cape.
Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa (2012)	It is considered best practise for bird monitoring to be undertaken on wind energy facility sites prior to the commencement of construction, in order to fulfil the requirements outlined by the Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. These guidelines seek to provide specialists with guidance on assessing the need, preparing, planning and implementing bat monitoring in respect of wind farm development and to standardize the way these data are collected and provide guidance when it comes to interoperating the results.	DEA Nature Conservation authority BirdLife	Developers can use the guideline document as a tool for determining potential impacts of wind energy facilities on bird communities at selected sites.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments (2012)	It is considered best practise for bat monitoring to be undertaken on wind energy facility sites prior to the commencement of construction, in order to fulfil the requirements outlined by the Best practice guidelines for bat monitoring and impact mitigation at proposed wind energy development sites in southern Africa. These guidelines seek to provide specialists with guidance on assessing the need, preparing, planning and implementing bat monitoring in respect of wind farm development and to standardize the way these data are collected and provide guidance when it comes to interoperating the results.	DEA Nature Conservation authority	Developers can use the guideline document as a tool for determining potential impacts of wind energy facilities on bat communities at selected sites.

APPROACH TO UNDERTAKING THE EIA PHASE

CHAPTER 5

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

Figure 5.1: The four stages of the EIA process

The EIA process for the proposed Goereesoe Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice GN33306 of 18 June 2010, in terms of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

5.1. Phase 1: Scoping Study

The Scoping Study aimed at detailing the nature and extent of the proposed Goereesoe Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs). The scoping phase of the process provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process of identification of potential impacts, and raise any issues of concern.

The draft Scoping Report compiled was made available at public places for I&AP review and comment from 02 March 2012 – 02 April 2012. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the Final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) in April 2012. The Final Scoping Report was accepted by the DEA, as the competent authority, in July 2012 (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA, as detailed in the Scoping Report.

5.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted and are discussed in more detail in Chapter 8 of this report. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aims to achieve the following:

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

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

5.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations 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 participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

5.3.1. Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and EIA report. Consultation with the regulating authorities (i.e. DEA and DEA&DP) has continued throughout the EIA process. On-going consultation included the submission of a Final Scoping Report (April 2012) following a public review period (and consideration of stakeholder comments received).

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

» Submission of a Final Environmental Impact Assessment (EIA) Report following the public review period.
» Authority site visit with DEA and DEA&DP
» Consultation with Organs of State that may have jurisdiction over the project:
  * Western Cape DEA&DP
  * Department of Energy
  * Department of Water Affairs
  * Department of Agriculture, Forestry and Fisheries (DAFF)
  * Department of Mineral Resources (DMR)
  * South African Heritage Resources Agency (SAHRA)
  * Civil Aviation Authority (CAA)

<u>Provincial Authorities</u>

- Heritage Western Cape
- Department of Transport and Public Works and various District Roads Departments
- Department of Water Affairs
- South African National Roads Agency
- Department of Land Affairs
- Swellendam Local Municipality
- Overberg District Municipality
- Cape Nature

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

5.3.2. Public Involvement and Consultation: EIA Phase

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

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

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

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

» Focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local and regional press: The Cape Times, Die Burger and Suidernuus)

» Written, faxed or e-mail correspondence

Records of all consultation undertaken are included within **Appendix E.** In summary, the public participation process for this project has included the following key steps/activities to date:

Scoping Phase	Advertisement of EIA Process – First round of adverts (The Cape Times, Die Burger and Suidernuus). These adverts were placed by Doug Jeffery Environmental Consultants (Pty) Ltd who initiated the EIA process. Savannah Environmental reinitiated the process in January 2012.	May 2011
	Focus group meetings and public meeting	April 2012
	Advertisement of Public Meeting & Availability of Scoping report for public review (Volksblad and Suidernuus)– Second round of adverts	February 2012
	Document (BID) and written notice Distribution of Background Information	February 2012 – April 2012
	Public review period for DSR	02 March 2012 – 02 April 2012
	Public meeting	7 March 2012
	Notification to registered I&APs that the Final Scoping report was available & submitted to DEA	April 2012
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting (Die Burger and Suidernuus) – Third round of adverts	February 2013
	Public meeting & stakeholder meetings	March 2013

5.3.3. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs to date over the duration of the EIA process have been synthesised into a Comments and Response Report (refer to **Appendix E** for the Comments and Response Report compiled from comments received during both the Scoping Phase and current EIA Phase).

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.

5.3.4. Assessment of Issues Identified through the Scoping Process

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

Specialist	Area of Expertise	Refer Appendix
Simon Todd of Simon Todd Consulting	Terrestrial Fauna	F
Dave McDonald of BergWind Botanical Surveys	Vegetation	G
Barbara Monteiro and Riccardo Ramahlo of Bio3	Avifauna	H
Kath Potgieter of EWT	Bats	I
Francois Knight of Agri Informatics Development Trust	Agricultural impact	J
Lourens du Plessis of MetroGIS	Visual impacts	K
Stephen De Kock of Perception Heritage Planning and Tim hart of ACO Associates	Heritage / Archaeology	L
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise	M
Pieter Arangie of ITS Engineers	Traffic impact	N
Tony Barbour of Tony Barbour Environmental Consulting and Research	Social Impact	O

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

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;

- 4 is low and will cause a slight impact on processes;
- 6 is moderate and will result in processes continuing but in a modified way;
- 8 is high (processes are altered to the extent that they temporarily cease); and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

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

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» The **status**, which is described as either positive, negative or neutral.
» The degree to which the impact can be reversed.
» The degree to which the impact may cause irreplaceable loss of resources.
» The degree to which the impact can be mitigated.

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

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

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

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

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

As INCA Energy has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. The draft Environmental Management Programme is included as **Appendix Q**.

5.3.5. Assumptions and Limitations

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

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

» The technical motivation as to the selection of the proposed development site (including details pertaining to the wind resource, etc.) provided by INCA Energy is sufficient and defendable.
» Only one site is considered feasible 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 pre-feasibility study undertaken by INCA Energy will be sufficient to motivate the selection of the site to DEA.
» It is assumed that the development site identified by INCA 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 INCA Energy. It is understood that this layout is preliminary at this stage, but it is assumed that the layout is approximately 80% accurate, and subject to change based on the environmental sensitivities/outcomes from this EIA phase.

Details of specific assumptions, limitations and/ gaps in knowledge for each of the environmental aspects / specialist studies undertaken are briefly highlighted below (refer to specialist studies contained in **Appendix F- O** for more details).

5.3.6. Public Review of Draft EIA Report and Feedback Meeting

This Draft EIA report has been made available for public review from **20 February 2013 –22 March 2013** at the following locations:

» Swellendam Public Library, 49 Voortrek Street, Swellendam, 6740
» Bedarsdorp Public Library, Church Street, Bedarsdorp, 7280

The report is also available electronically on www.savannahSA.com.

Comments can be submitted to **Sustainable Futures ZA** by 22 March 2013 as written submission via fax, post or e-mail.

In order to facilitate comments on the Draft EIA Report, a public feedback meeting will be held during the review period for the Draft EIA Report as follows:

» **DATE:** 6 March 2013
» **TIME:** 17:00 - 18:30,
» **VENUE:** Swellendam Town Hall - Side Hall, Voortrek Street, Swellendam

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Die Burger and Suidernuus on 20 February 2013 (refer to **Appendix D**).

5.3.7. Final Environmental Impact Assessment (EIA) Report

The final stage in the EIA Phase will entail the capturing of responses from I&APs on the Draft EIA Report in order to refine this report. The Final EIA report is submitted to the decision-making Authorities, and it is this Final report upon which a decision is made regarding the proposed project.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the Draft EIA Report provides a description of the environment that may be affected by the proposed Goereesoe Wind Farm near Swellendam in the Western 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 limited collected field data undertaken by specialists who have a working knowledge of the area, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist scoping reports contained within Appendices F - O.

6.1 Regional Setting

The site proposed for the Goereesoe Wind Energy Facility is located in a rural area where the predominant farming activity is sheep and grain cultivation. The town of Swellendam (located within the Overberg District Municipality) is located 30 km north-east of the proposed site for the wind energy facility. Within 50 km of the site proposed for the wind energy facility are the towns of Bonnievale in the Langeberg Municipal area as well as Bredasdorp and Riviersonderend in the Swellendam Municipal area.

6.2 General Description of Site and Surrounding Area

The proposed development area is located on the following farm portions:

» Portion 0 of Farm 432 Goereesoe
» Portion 2 of Farm 432 Goereesoe
» Portion 4 of Farm 432 Goereesoe
» Portion 5 of Farm 432 Goereesoe

To the north of the proposed development site, at a distance of approximately 35 km, the Langeberge form the skyline, and to the north-west at a distance of 28 km and further the Riviersonderendberge can be seen.

The site is situated on the undulating terrain between the mountains to the north and the coastline which lies ~30 km to the south. The area around the site is characterized by undulating farmlands most of which are used for the cultivation of winter grain crops although there is some livestock farming as well.

The area is crossed by numerous water courses, most of them seasonal. Those in the north-western part of the site feed eventually into the Soetrivier located to the west of the site, and those in the south-eastern parts of the site feed into Brakkuil se Loop located to the south of the site.

The areas immediately adjacent to the watercourses still carry natural fynbos and the steepness of the terrain allows for fairly extensive fynbos areas along the watercourses in the south-eastern portions of the site. Most of the area, however, has been cleared for agriculture and used as such over a prolonged period of time.

The R319 that links Bredasdorp with the N2 national highway bisects the site. This road follows the contours, resulting in a relatively winding route that at times allows for panoramic views over the intervening terrain, and at times, when passing between the hills, results in fairly limited areas of view. Apart from the local farm roads there are no other roads on or near to the site.

The hills on which the turbines are proposed to be sited range between 250m and 320m above sea level whereas there are some points in the south of the site associated with the watercourses that fall as low as 180m.

6.3 Site access

The farm Goereesoe is accessed by means of a gravel road that turns off the R319 public road approximately 41 km from Swellendam. The site can also be accessed by vehicle along the R319 which diverts toward the south from the N2, approximately 11km south west of Swellendam.

6.4 Landuse and landcover of the study area

Much of the proposed area is currently classified as Vacant or Unspecified, but aerial images indicate significant dryland agriculture (winter crops – grains and seed-oil).

The Goereesoe Farms are typical of most farms in the region where as much land as possible has been transformed from the natural renosterveld to grain-fields. Only areas on particularly steep terrain or where the soil is not at all suitable for cultivation have not been ploughed. In some place, even areas where a thin cap of duricrust (hardpan) is present this has been removed and the underlying soil ploughed. Where the silcrete is relatively unweathered and deep it has generally not been removed. However, these areas are then used for running livestock, both sheep and cattle.

6.5 Topography

The extensive area between the Riviersonderend and Langeberg mountain ranges and the sea is known as the Rûens. It takes its name from the undulating 'whale-back'

topography formed by erosion of the Bokkeveld Group shales that are the dominant rock-type of the region (Lambrechts, 1979). The shales weather to form clay-rich arable soil. Large areas of natural habitat that were once covered with renosterveld are now transformed to agriculture. Fragmented and isolated patches of renosterveld remain. These have high conservation value since they are the last habitat for many plants and other organisms that once ranged more extensively in the renosterveld vegetation.

Within the Bokkeveld shale matrix are outcrops of silcrete over deeply weathered pallid soils. These are generally the highest points in the landscape; around 300 m above mean seal level. The silcrete caps originated in humid climates during the Cretaceous (Partridge, Botha & Haddon, 2006). They are resistant to weathering and the remnant of a wider occurrence of these duricrusts are now seen capping prominent hills in the Overberg. Such silcrete capped hills (Figure 6.1) are found in areas of the Goereesoe Farm.

Figure 6.1: Silcrete cap on a hill of Goereesoe 432

6.6 Climatic Conditions

The proposed development site lies within a climate zone which is transitional between the winter-rainfall region of the extreme Western Cape and the non-seasonal rainfall region in the east. The climate of the site is most similar to that of Bredasdorp for which rainfall (Figure 6.2) and temperature (Figure 6.3) information is available. Rain occurs in the winter months when westerly winds associated with cold fronts sweep across the southern Cape. During spring and autumn cold onshore winds that blow over the warm Agulhas Current draw moisture which is deposited over the land. Mean annual precipitation is in the order of 400 mm per annum (Figures 6.4 & 6.5).

Winter days are cool (12 - -19°C) with the nights cold but seldom freezing. Summers are warm to hot with daytime temperatures mostly from 20 - 25°C but occasionally exceeding 30°C (Figures 6.3).

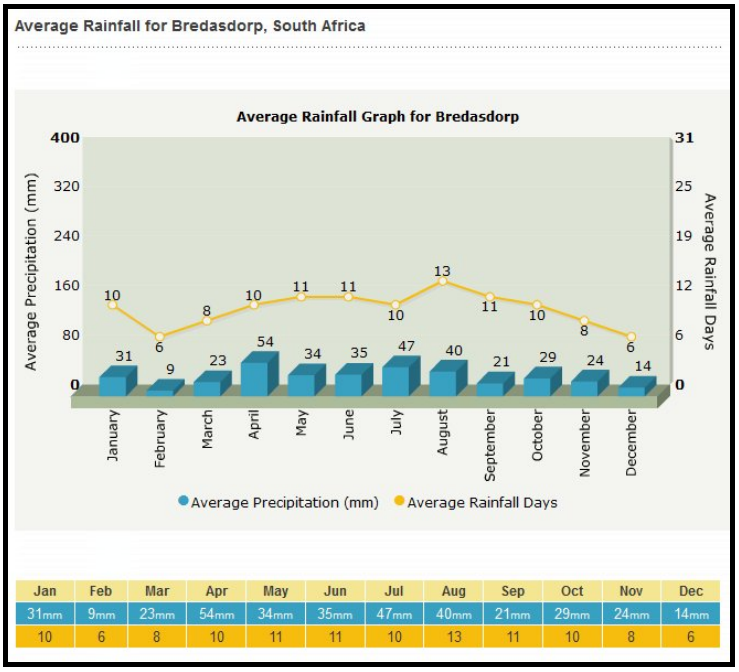

Figure 6.2: Rainfall for Bredasdorp (http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Bredasdorp/2611064/info.aspx)

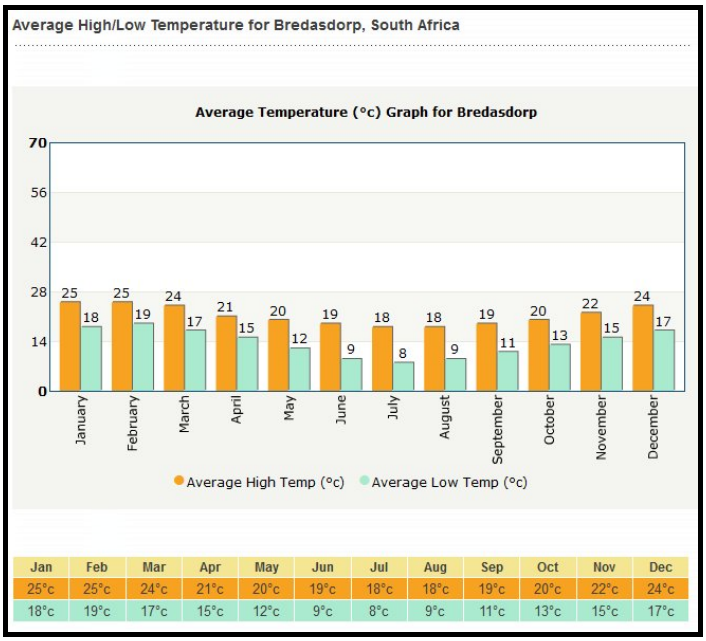

Figure 6.3: Temperatures for Bredasdorp

(http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Bredasdorp/2611064/info.aspx)

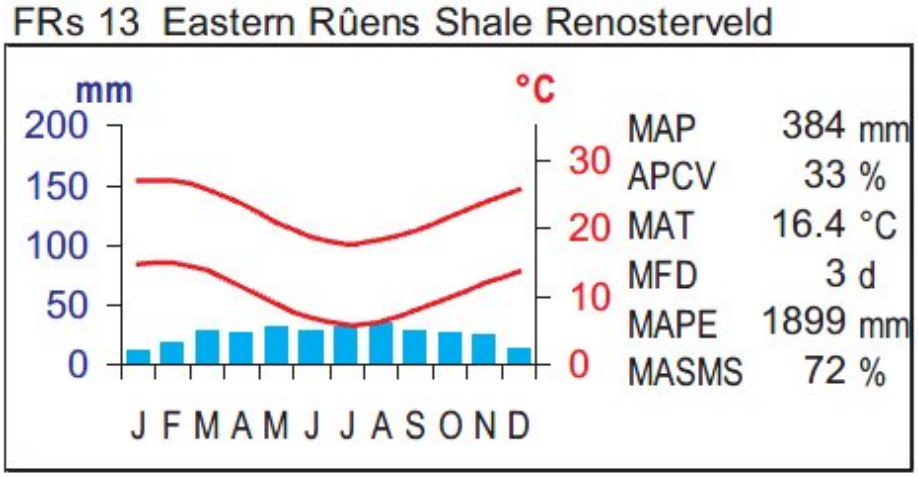

Figure 6.4: Climate diagram for Eastern Rûens Shale Renosterveld (from Rebelo *et al.* 2006 in Mucina & Rutherford, 2006)

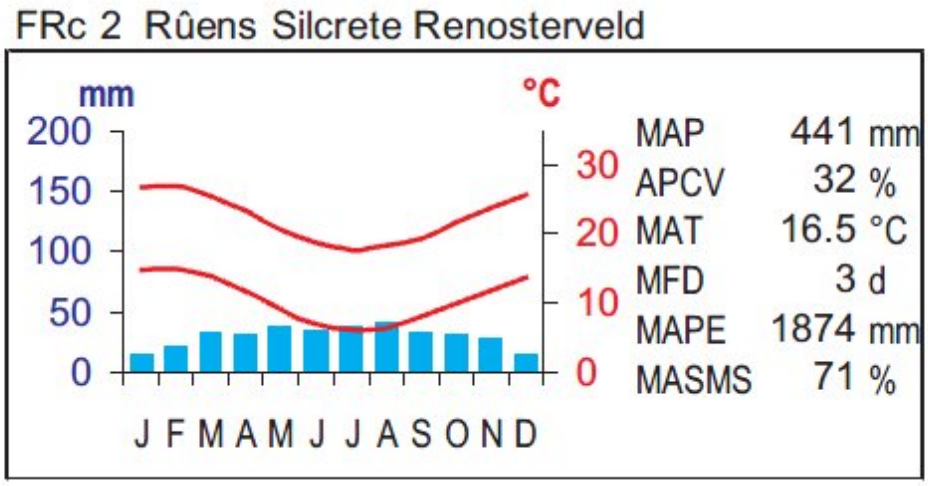

Figure 6.5: Climate diagram for Rûens Silcrete Renosterveld (from Rebelo *et al.* 2006 in Mucina & Rutherford, 2006)

6.7 Drainage lines and Wetlands

There are numerous minor drainage lines as well as small earth dams within the site (Refer to figures 6.6 and 6.7). Although many of the drainage lines are quite degraded on account of alien plant invasion, disturbance and encroachment from the croplands, they nevertheless provide important habitat for amphibians and reptiles and also provide corridors for movement through the heavily transformed matrix.

Figure 6.6: A section of the larger drainage lines which traverses the northern section of the site. Although the river itself is not likely to flow year-round, the presence of freshwater crabs suggests that at least some of the pools are perennial in nature.

Figure 6.7: Drainage line within the site, illustrating the corridor nature of the drainage lines with fringing riparian vegetation as well as patches of Renosterveld.

6.8 Geology and Soils

The Rûens area is situated on shales and siltstone of the Bokkeveld Group, with silcrete and ferricrete remnants of the Grahamstown Formation, now protruding by a few meters out of the surrounding landscape as small isolated “islands”.

The soils in the area have a shallow and stony nature. The main soil limitations are:

» Effective depth
» High gravel and stone content
» Surface crusting
» Hard setting
» Wetness
» Low clay content

These limitations are also reflected in the information provided by the Land Type data (ARC Institute for Soils Climate and Water). Portions of two Land Types are found in the study area, namely Fb38 on the upper slopes and crest areas and Fb32 on the mid and footslopes (Refer to Figure 6.8).

Table 6.1: Information on the dominant and subdominant soil types, abstracted from the Land Type data

Soil Form	Depth	Clay% A	Clay% B	Potential Rating
Land Type Fb32				
Glenrosa	150 - 300	6 - 20	20 - 35	L
Mispah	100 - 200	6 - 15		VL
Swartland	250 -400	35	35	M
Swartland	250 -350	20 - 25	35 - 55	L-M
Land Type Fb38				
Glenrosa	150 - 300	6 - 20	20 - 35	L
Mispah	150 - 200	6 - 15		VL
Swartland	200 - 600	25 - 40	40	M-MH

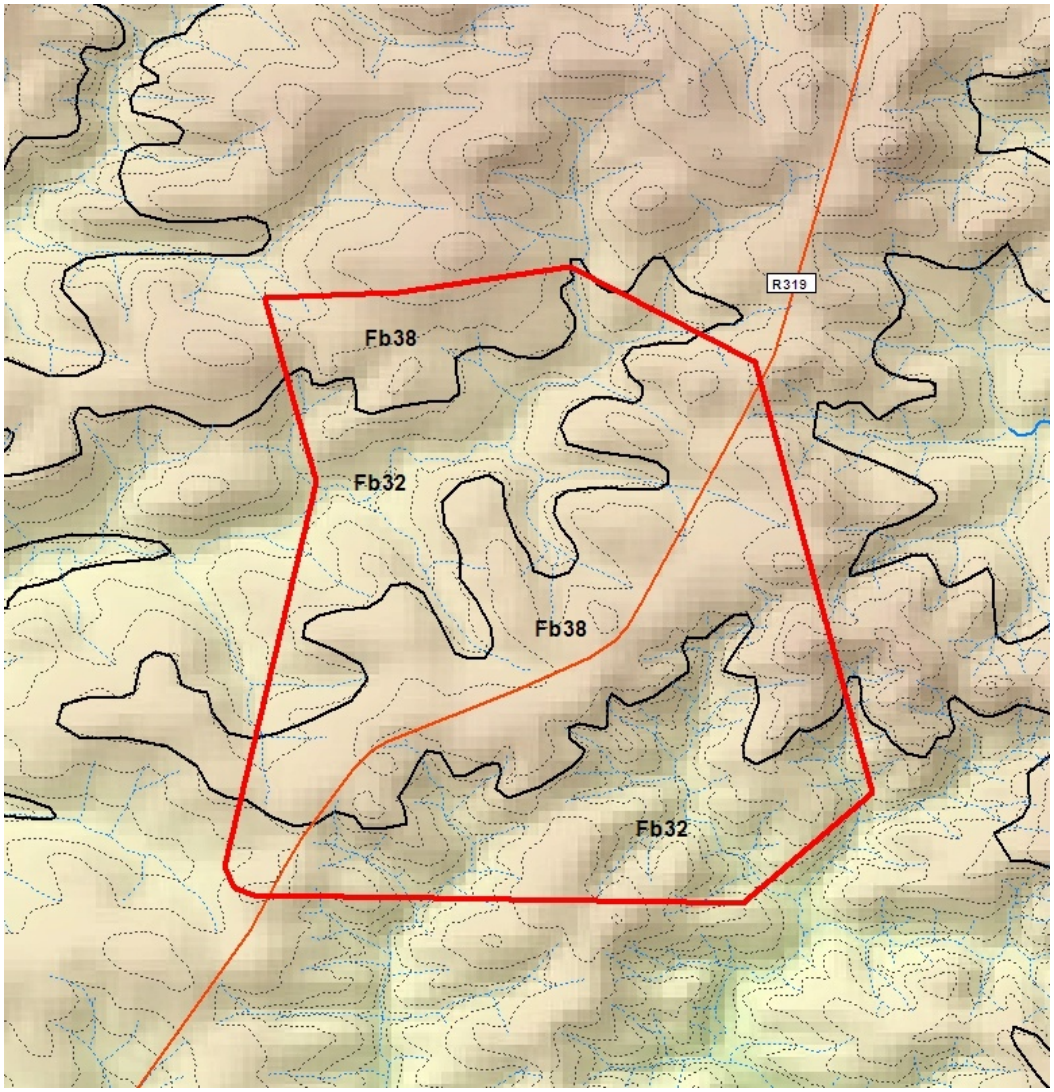

Figure 6.8: The study area spans portions of two land types, Fb32 and Fb38

6.9 Agricultural Potential

The study area is situated in the middle of the "Rûens" homogenous farming area (HFA), as defined by the Provincial Department of Agriculture. Here the main agricultural activity is small grain production in combination with sheep farming. A crop rotation system of canola, wheat, barley and lucerne for grazing is mostly followed, leading to 50-60% of the land being used for cash crop production in any year.

Throughout this HFA, where the soils and slopes permit, the natural vegetation has been removed to make way for cultivation, leading to a landscape largely converted to agriculture (Refer to Figure 6.9). Due to the lack of irrigation water there is no irrigated cultivation in close proximity to the site. The nearest irrigation is ±18 km to the north along the Riviersonderend and Breede River.

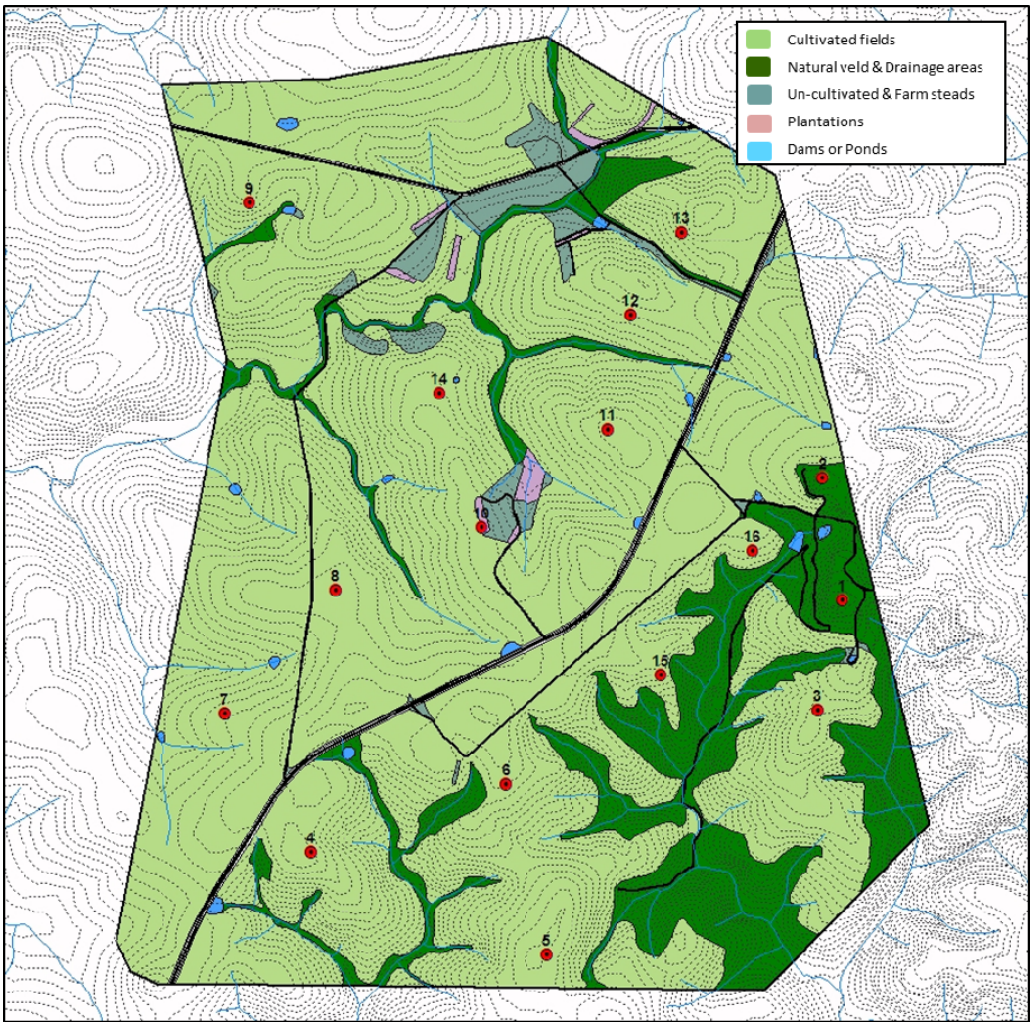

Figure 6.9: Agricultural land use at Goreesoe (Layout alternative 1).

6.10 Ecological Profile of the Study Area

6.10.1. Vegetation

Originally two vegetation types were found on Goereesoe Farm as mapped and classified in the national classification of the vegetation of South Africa (Rebelo *et al.* 2006 in Mucina & Rutherford, 2006). The most extensive would have been Eastern Rûens Shale Renosterveld (FRs13) and Rûens Silcrete Renosterveld (FRc2) would have occurred to a lesser extent, confined to silcrete substrates scattered through the shale-dominated landscape (Refer to Figures 6.10 & 6.12). As noted in the Vegetation report (Refer to appendix G) both of these renosterveld vegetation types fall within the Fynbos Biome and are species rich. They have become increasingly threatened due to the pressure of transformation to agriculture as is discussed below (Von Hase *et al*. 2003; Holness & Bradshaw, 2010).

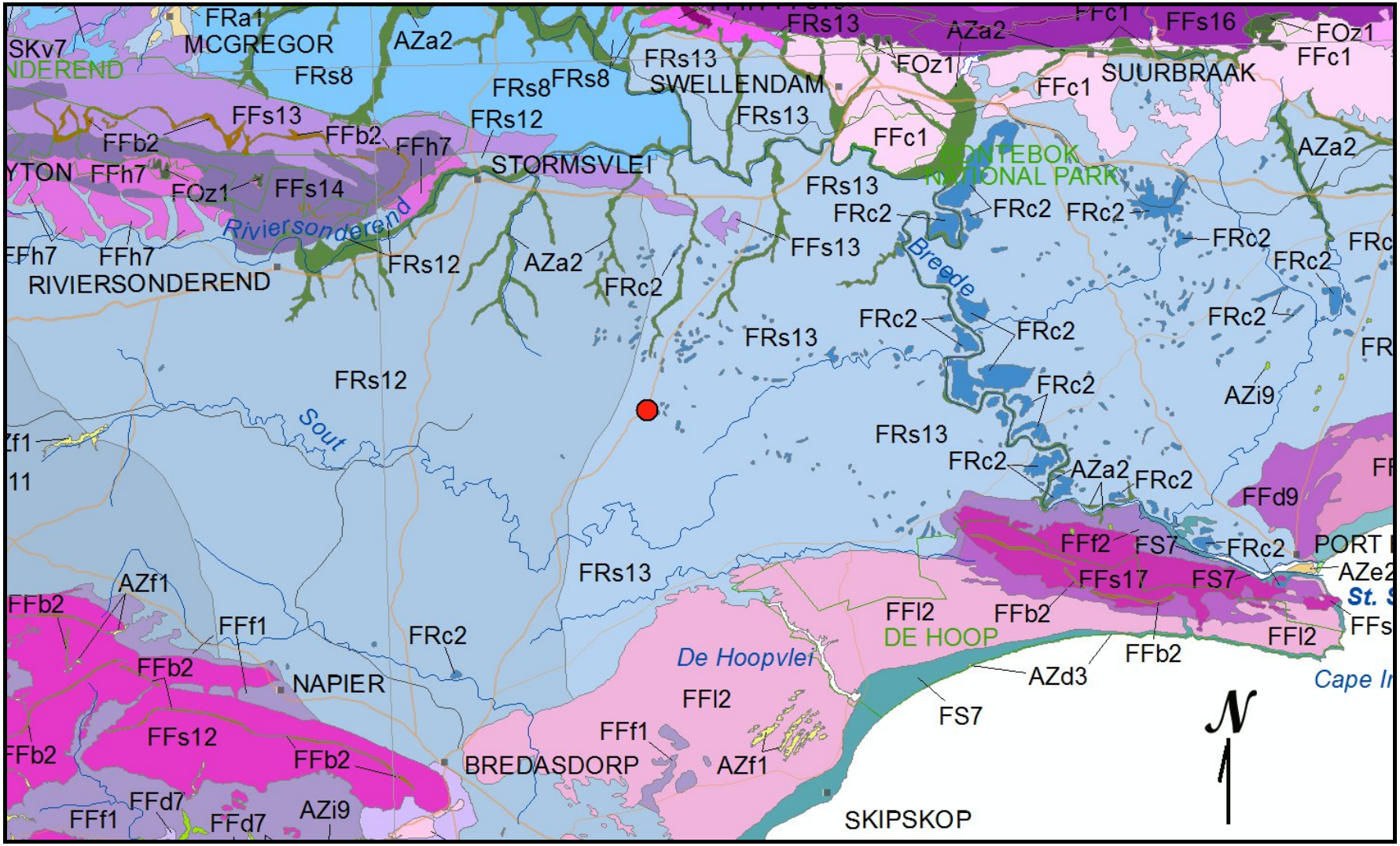

Figure 6.10: Portion of the *Vegetation map of South Africa, Lesotho, and Swaziland* (Mucina, Rutherford & Powrie 2005) with the study area indicated by a red dot. The two vegetation units of importance are Eastern Rûens Shale Renosterveld (light-blue: FRs13) and Rûens Silcrete Renosterveld (dark blue – FRc2)

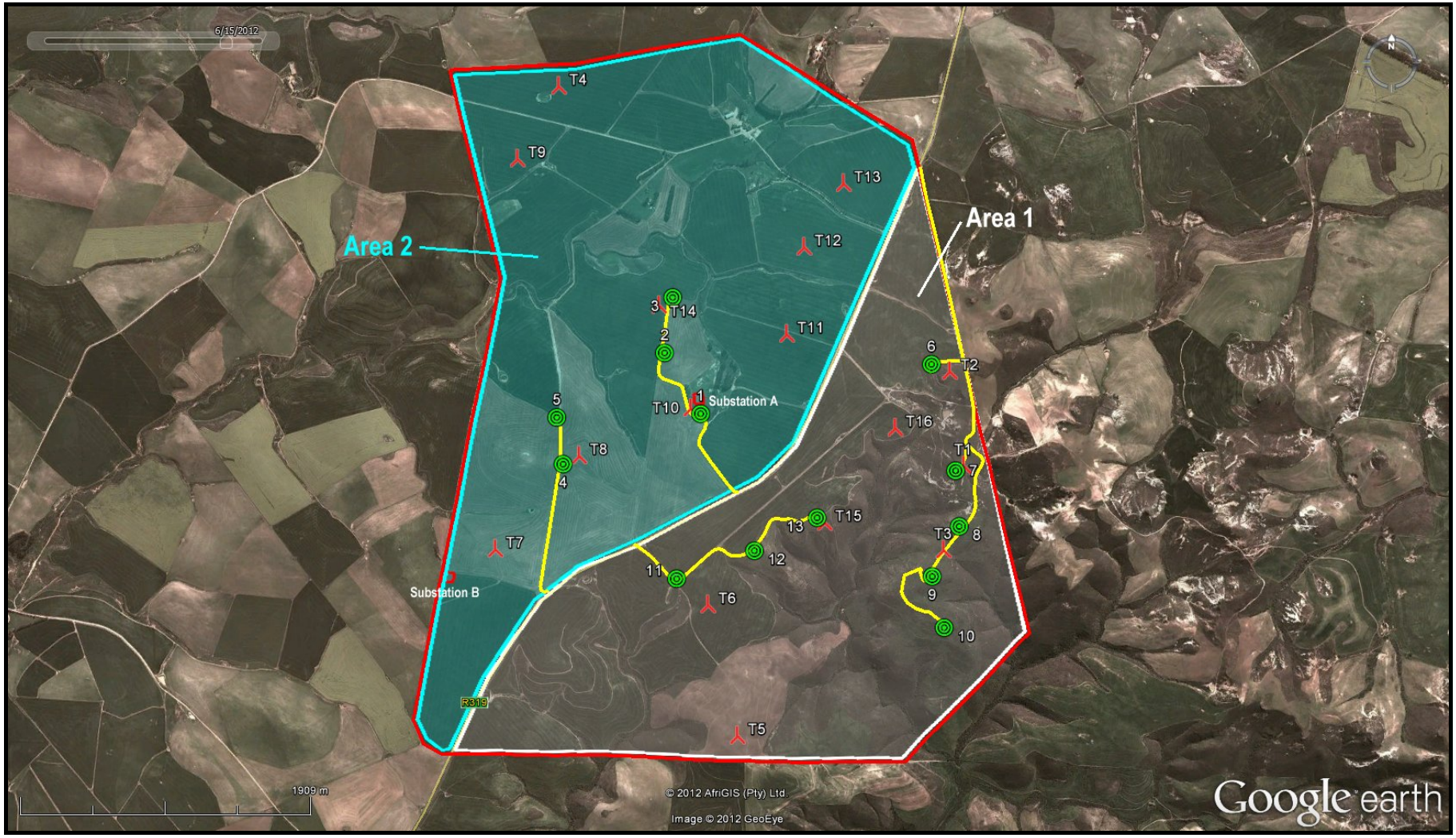

Figure 6.11: Aerial image (Google Earth ™) of the study area (red boundary). The originally proposed turbine original positions (Alternative 1) are shown as red 'turbine' icons (T#). The proposed final layout of turbines (Alternative 2 is shown as numbered green-dot icons. The access roads and cable routes are shown as yellow lines.

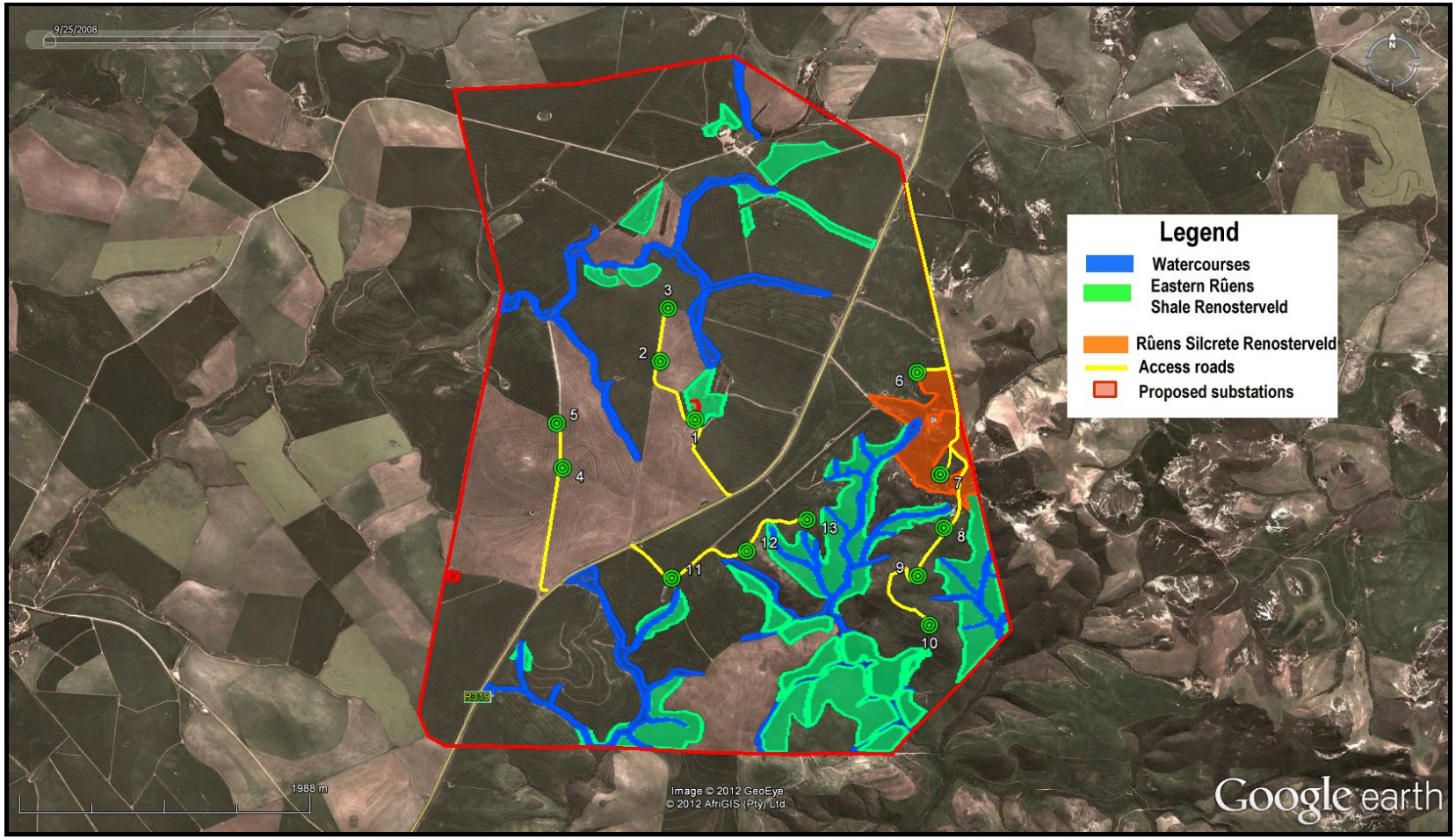

Figure 6.12: Map of the vegetation of Goereesoe Farm with location of proposed wind-turbines. The areas not coloured are areas of transformed vegetation.

Vegetation of Area 1[6] (area south east of the R319)

Area 1 has greater relief than Area 2 with more extensive watercourses or drainage lines. As much of the arable land has been cultivated as possible but more of Area 1 has been uncultivated and there are more extensive patches of Eastern Rûens Shale Renosterveld remaining. These fragments are also linked by the corridors formed by the intact habitat of the watercourses (Refer to Figure 6.12) which means that the natural parts of Area 1 have good connectivity. This in turn allows ecological processes to function more normally. A typical example of cultivated land with wheat bordering on remnant Eastern Rûens Shale Renosterveld as found in Area 1 is shown in Figure 6.13.

Along the mid-eastern boundary of Area 1 is an area of relatively intact Rûens Silcrete Renosterveld. The vegetation is a low shrubland with a high graminoid component. It is species rich and the species recorded during the survey included *Albuca maxima, Anthospermum sp., Arctotheca calendula, Arctotis acaulis, Aspalathus pycnantha, Aspalathus spinosa, Asparagus capensis, Asparagus rubicundus, Asparagus sp. (cf. lignosus), Berkheya barbata, Bobartia cf. longicyma, Bulbine cf. lagopus Carissa bispinosa, Cineraria geifolia, Clutia ericoides, Cymbopogon marginatus, Diospyros dicrophylla, Drosanthemum hispidum, Ehrharta cf. villosa, Elytropappus rhinocerotis, Helichrysum crispum, Helichrysum felinum, Heliophila subulata, Hermannia saccifera, Hermannia sp., Hermannia trifoliata, Indigofera brachystachya, Jamesbrittenia revoluta, Kedrostris nana, Leonotus leonurus, Lycium sp., Massonia depressa, Merxmuellera stricta, Myrsine africana, Oedera squarrosa, Ornithogalum sp., Pentaschistis eriostoma, Ruschia sp., Searsia lucida* and *Silene undulata.*

Although the vegetation that would be found near the 18m wind test mast site (corresponding to turbine 7 in proposed layout is Rûens Silcrete Renosterveld, this area has been disturbed by ploughing and now has a stand of weedy *Raphanus raphanistrum*. Some hardy mat-forming vygies persist.

[6] Refer to figure 6.11 which indicates “Area 1”

Figure 6.13: A view southwestwards in Area 1 (area of Goereesoe Farm south east of the R319). In the foreground is Rûens Silcrete Renosterveld, in the middle-ground is Eastern Rûens Shale Renosterveld with areas of cultivated shale soils behind

Vegetation of Area 2[7] (area north west of the R319)

The remaining Eastern Rûens Shale Renosterveld in Area 2 is highly fragmented and only approximately 28 ha of this vegetation type remain in Area 2 compared with the less fragmented approximately 126 ha of this vegetation type in Area 1. Therefore, from a conservation perspective Area 2 has very low value. It is practically covered with wheat-lands on the shale soil (Figure 6.14). No Rûens Silcrete Renosterveld is found in Area 2.

[7] Refer to figure 6.11 which indicates "Area 2"

Figure 6.14: Typical wheat-lands on Goereesoe Farm, covering extensive areas on shale soil, having replaced Eastern Rûens Shale Renosterveld

Conservation Status

Both Eastern Rûens Shale Renosterveld and Rûens Silcrete Renosterveld are listed as Critically Endangered A1 in the National List of Threatened Ecosystems (Government Gazette, 2011). This means that there should be no further loss of these vegetation types since national conservation targets for both of them will not ever be met. This immediately raises the need for caution when encountering these vegetation types.

The only Red Listed species encountered during the survey was *Bobartia longicyma* (VU) but it was assumed as a precaution (precautionary principle) that other threatened species would occur within the study area. This is indeed the case as borne out by information supplied by Ms Odette Curtis, Project Manager of the Overberg Conservation Trust. A list of threatened species recorded by Ms Curtis and Dr Charles Stirton at the location S 34° 16' 20.89" E 20° 14' 52.33", a location close to that of the proposed Turbine 7 is as follows:

Aspalathus millefolia (Vulnerable)
Bobartia longicyma (Vulnerable)
Elegia recta (Vulnerable)
Elegia verreauxii (Near-Threatened)
Gibbaeum haaglenii (Endangered)

Leucadendron coriaceum (Endangered)
Peucedanum striatum (Near-Threatened)
Relhania garnotii (Vulnerable)

6.10.2. Terrestrial Fauna

Mammals

Approximately 46 mammal species potentially occur at the site (Appendix 2 of Terrestrial Fauna Report- Refer to Appendix F of this report). However, given the highly impacted nature of the study area and in particular the area affected by the development, it is likely that many of these do not occur within the affected areas or at the site in general. The south eastern section of the site is definitely the most significant in terms of mammals as it contains the largest extent of intact habitat and is also connected to other areas of intact habitat to the south and east. Larger mammals observed to be present at the site include Grey Rhebok, Steenbok, Common Duiker, Porcupine and Aardvark. Smaller mammals observed include Namaqua Rock Mouse, Bush Vlei Rat, Scrub Hare, Cape Gerbil, Cape Grey Mongoose and Marsh Mongoose. Three species of conservation concern potentially occur at the site, the White-tailed Mouse (Endangered), Leopard (Near Threatened) and the Honey Badger (SA RDB Endangered). Given the high level of transformation and intensive agriculture in the area, it is highly unlikely that the Leopard occurs at the site, but both the White-tailed Mouse and Honey Badger potentially occur at the site. As the intact habitats would be most important for these species, the development would have a low impact on these species as the loss of intact habitat would be very low.

Reptiles

The site lies in or near the distribution range of at least 35 reptile species (Appendix 3 of Terrestrial Fauna Report- Refer to Appendix F of this report). This is a comparatively low total suggesting that the site has a relatively depauperate reptile assemblage. Based on distribution maps and habitat requirements, the composition of the reptile fauna is likely to comprise 2 tortoises, 1 terrapin, 16 snakes, 14 lizards and skinks and 2 geckos. There are no listed species which are known to occur in the area. Species observed include the Cape Girdled Lizard which was observed on the rocky outcrops, the Angulate Tortoise, Brown House Snake and Cape Skink. The most important habitats at the site for reptiles are likely to be the rocky outcrops for lizards as well as the densely vegetated lowlands and areas around the drainage lines for snakes. As the development is largely restricted to the transformed areas, the impact on reptiles would be low. The turbines within the natural vegetation (i.e. turbines 6 and 7) are however within areas that are relatively sensitive from a reptile perspective and the turbines should preferably be relocated to an adjacent less sensitive area.

Amphibians

The site lies within or near the range of 7 amphibian species, indicating that the site is not very rich in terms of amphibians. The only species observed at the site was the Cape River Frog, which was common along the larger drainage lines as well as around the earth dams at the site. Other species likely to be common at the site are the Raucous Toad which is likely to quite widespread and the Common Platanna which is likely to occur within any perennial still water bodies at the site. Although there are no listed amphibians or very narrow endemics which occur in the area, the site lies with the distribution range of two Western Cape endemics, the Cape Mountain Rain Frog and the Banded Stream Frog,. However, both of these species are associated with the fynbos mountain ranges of the Western Cape and are not likely to occur within the more arid Renosterveld lowlands of the site. As the drainage lines and water bodies at the site would be little impacted by the development which avoids these features, the impact on amphibians and their habitats are likely to be low.

6.10.3. Bats

The vegetation description partially helps to describe the species likely to occur in the study area. Specific features within the landscape will further affect which species occur there. These specifics, or "micro" habitats, are formed by a combination of factors such as vegetation, land cover and man-made structures. Micro habitats will be critically important in siting the proposed turbines within the affected farms. The following micro-habitats were identified during the site survey by the bat specialist and Google Earth satellite images were also used to assess areas inaccessible during the survey:

- **Wetlands:** Wetlands are characterized by slow flowing water and tall emergent vegetation. Insects such as midges and mosquitoes often breed at wetlands emerging in large numbers, creating a perfect feeding site for many bat species. A number of wetland-like areas were identified on the site.
- **Dams and reservoirs:** Due the standing nature of water in dams and reservoirs many insects use dams as breeding sites. The presence of these insects often attracts insect-eating bats. Many active dams and reservoirs were identified on the site.
- **Thicket:** Many of the bat species listed as possibly occurring on the site are clutter and clutter-edge feeders. The presence of thicket or bush on the site may increase the likelihood of such species being present and any alteration to this habitat may have negative effects on the presence of bats in the area, possibly even their survival.
- **Man-made structures:** Buildings are favoured by many bat species as safe, dry roost sites. They will often roost in the roofs of these structures. The

farm houses, staff houses and abandoned structures on the site all present suitable roosting habitat for many bat species.

- **Cliffs, rocky outcrops and valleys:** A number of bat species will roost in rocky outcrops and small caves. They are thought to use updrafts along cliff faces forage for insects and often feed in valleys where rivers are more likely to be found. A number of rocky cliffs were identified along river valleys on the site.

Bats are broadly divided into two groups, insect- and fruit-eating bats. Fruit-eating bats are generally found in the warmer, eastern parts of the country where fruit trees, often of a commercial nature, are commonly found. A number of species do, however, occur in the Western Cape Province and it is possible that some may occur at the study site (Table 6.2). Insect-eating bats are found across the entire country, including the study site. Therefore, anything that attracts insects is likely to, in turn, attract bats. For example, wetlands, pans, rivers, dumping sites, and animals such as cows, sheep and horses are all likely to attract both insects and bats and the presence of these features should all be taken into account when considering the siting of wind turbines.

Desktop review

Based on historically recorded and modelled distributions by Friedmann and Daly 2004 and Monadjem *et al.* 2010 the number of bat species with the potential to occur in the study area numbers 18 species (Table 6.2). Of the 18 species identified as potentially occurring in the study area one is Vulnerable, three Near threatened and 14 Least Concern. Eight of the identified species are considered highly likely to occur in the study area (*Minopterus natalensis, Eptesicus hottentotus, Myotis tricolor, Neoromicia capensis, Nycteris thebaica, Rhinolophus clivosis, Rhinolophus capensis* and *Tadarida aegyptiaca*), five considered moderately likely (*Mops midas, Cleotis percivalli, Rhinolophus swinnyi, Rousettus aegypticus* and *Kerivoula lanosa*) and five are unlikely but possible to occur (*Eidolon helvum, Miniopterus fraterculus, Epomophorus wahlbergi, Taphozous mauritianus,* and *Rhinolophus darlingi*).

Table 6.2: Potential bat species in the study area

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS	LIKELIHOOD OF OCCURRENCE
Cleotis percivali	Percival's Short-eared Trident Bat	Woodland	V	Moderate
Eidolon helvum	African Straw-coloured Fruit Bat	Fruit-producing woodlands	NT	Low
Miniopterus natalensis	Natal Long-fingered Bat	Savanna/grassland	NT	High
Rhinolophus swinnyi	Swinney's Horseshoe Bat	Savanna/woodland	NT	Moderate
Mops midas	Midas Free-tailed Bat	Savanna/woodland	LC	Moderate

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS	LIKELIHOOD OF OCCURRENCE
Miniopterus fraterculus	Lesser Long-fingered Bat	Savanna/grassland	LC	Low
Rousettus aegypticus	Egyptian Fruit Bat	Fruit-producing woodlands	LC	Moderate
Epomophorus wahlbergi	Wahlberg's Epauletted Fruit Bat	Forest, riparian vegetation	LC	Low
Eptesicus hottentotus	Long-tailed Serotine	Rocky outcrops/caves	LC	High
Myotis tricolor	Temminck's Myotis	Savanna/mountains	LC	High
Taphozous mauritianus	Mauritian Tomb Bat	Savanna/woodland	LC	Low
Neoromicia capensis	Cape Serotine	Wide tolerance	LC	High
Nycteris thebaica	Egyptian Slit-faced Bat	Savanna/karoo	LC	High
Rhinolophus clivosus	Geoffroy's Horseshoe	Savanna/woodland	LC	High
Rhinolophus darlingi	Darling's Horseshoe Bat	Savanna/woodland	LC	Low
Rhinolophus capensis	Cape Horseshoe Bat	Coastal areas, caves	LC	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Wide tolerance	LC	High
Kerivoula lanosa	Lesser Woolly Bat	Unknown	LC	Moderate

* V – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient (IUCN)

Driven transect surveys

Two main transects were driven over two different nights, the 22nd and 23rd of October. The first transect traversed as much of the section of Goereesoe south and east of the R319 regional road as possible. The second transect traversed as much of the section of Goereesoe north and west of the R319 regional road as possible (refer to figure 6.15). Four (4) species of bats were detected by the EM3 bat detector during these transects – *Neoromicia capensis, Miniopterus natalensis, Mops midas* and *Tadarida aegyptica.* The number of bat passes recorded are shown in Table 6.3. Please note that these results indicate diversity rather than abundance (as there is no way to know whether the same individual is being recorded repeatedly) and, in addition, highlight potentially sensitive areas.

Table 6.3: Bat passes recorded during driven transect surveys

Species	Common name	Number of passes
Miniopterus natalensis	Natal Long-fingered Bat	11
Neoromicia capensis	Cape Serotine	10
Tadarida aegyptica	Egyptian Free-tailed Bat	7
Mops midas	Midas Free-tailed Bat	3
Unknown		2

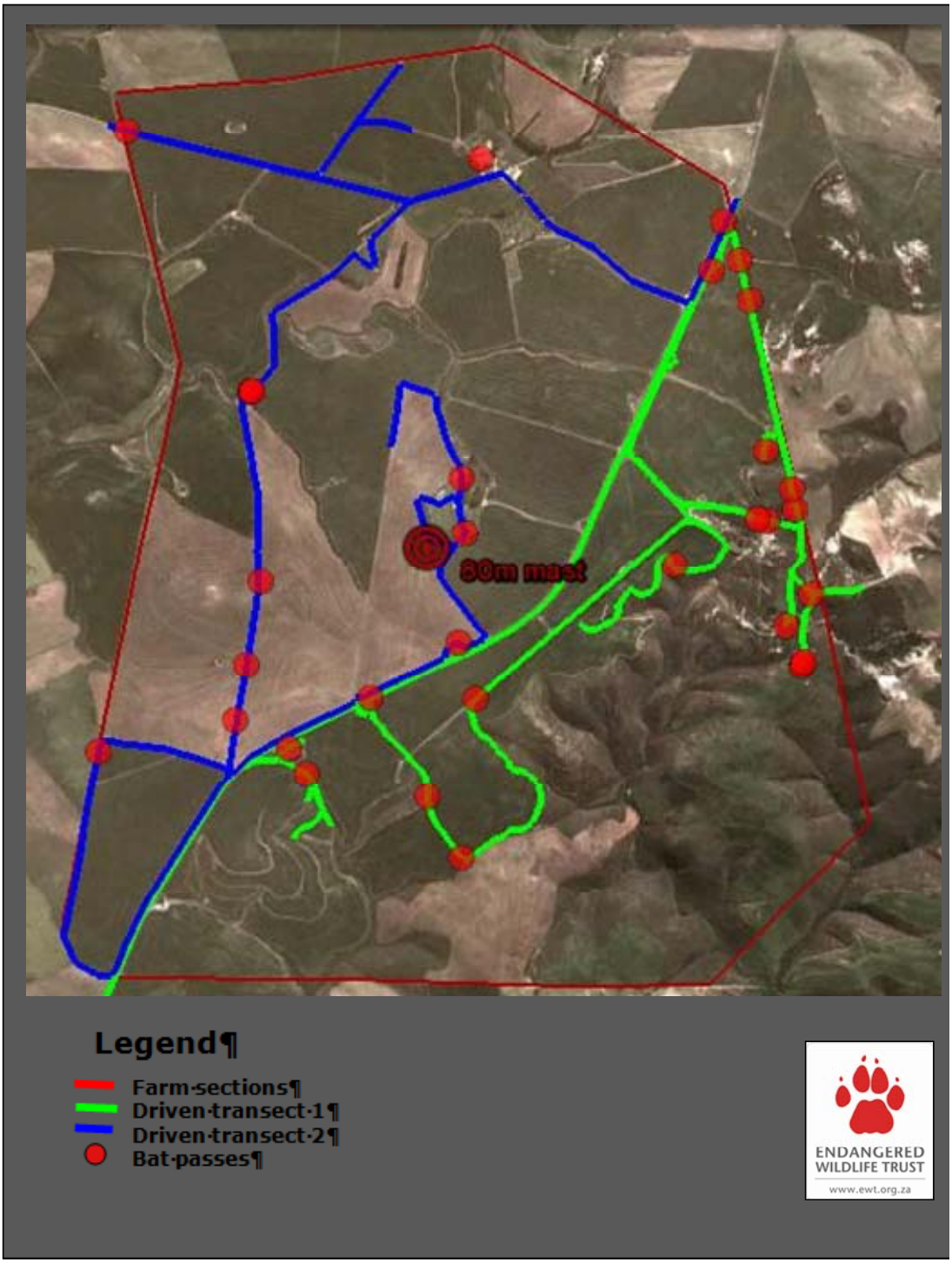

Figure 6.15: Results of driven transect surveys showing bat passes

6.10.4. Avifauna

The primary data source used for this assessment was the Southern African Bird Atlas Project (SABAP 1) (Harrison *et al*., 1997), complemented with the information from the second bird atlas (SABAP2). This project makes use of data collected throughout various seasons and conditions and provides far more insight into which species could occur in the area than the brief site survey undertaken. A full list of all bird species recorded by Harrison *et al*. (1997) for the relevant four quarter degree squares (refer to figure 6.16) is included in Appendix IV of the bird report- refer to Appendix H of this report.

Up to approximately 290 bird species were considered that could occur in the area, with the combined information from the SABAP1, SABAP2 and the Coordinated Waterbird Counts, since the De Hoopvlei River is located just a few kilometres from the study area. The squares considered for this analysis have been thoroughly counted, with 58 to 249 cards submitted per square.

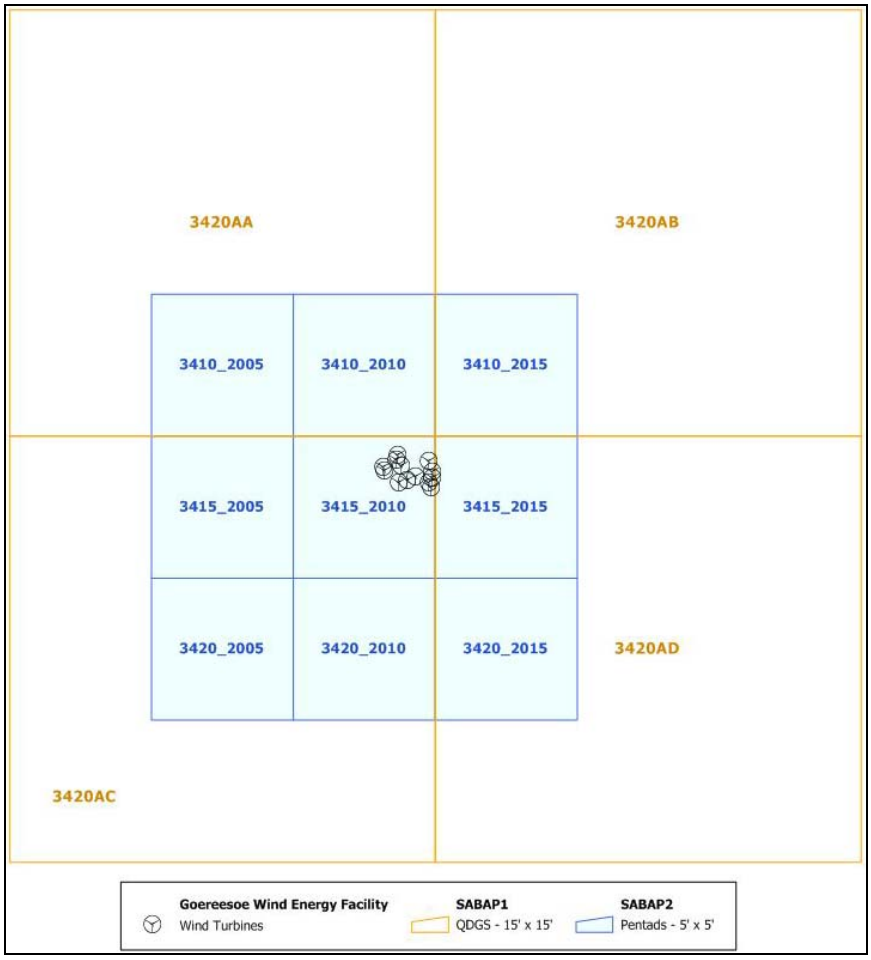

Figure 6.16: Schematic representation of the SABAP 1 QDGS and SABAP 2 Pentads considered for the compilation of the avifauna report.

A total of 31 Red Listed bird species were listed as potentially occurring across the proposed wind energy facility site and immediate surroundings, comprising 2 "Endangered", 11 Vulnerable and 18 "Near-threatened" species (Appendix IV of the bird report- refer to Appendix H of this report). Due to the large diversity in avifauna in southern Africa (over 900 species) impact assessments, such as this one, focus by necessity on Red Listed and/or priority species. At this site, this allows the study to focus on 27 species rather than approximately 300 (Table 6.4). From the selected species, most that could occur in the development area or its surroundings and that could be negatively affected by this project, due to their high risk of collision or sensitivity to disturbance or habitat loss are threatened species at a national level (Barnes, 2000). The priority species potentially occurring at the site can be broadly classified in three grouping categories, namely: medium to large terrestrial species, soaring species and small birds:

- **Medium to large terrestrial species**:
  This includes medium to large birds that spend most of the time foraging on the ground. They do not fly often and when they do it's generally short distances at low to medium altitude, usually powered flight. Some species undertake longer distance flights at higher altitudes. At the wind farm site, cranes, bustards, secretary birds, francolins and korhaans are included in this category.

- **Soaring species**:
  This includes species that spend a significant time flying in a variety of flight modes including soaring, kiting, hovering and gliding at medium to high altitudes. At the wind farm site, these are mostly raptors and storks.

- **Small birds**:
  At the wind farms site these are mainly passerines. They spend most of the time on the ground or calling from perches but display flights at medium height are also undertaken by some species.

Table 6.4 - Priority species potentially occurring at the site, considered central for the avian impact assessment of the Goereesoe Wind Energy facility, selected on the basis of its sensitivity to wind energy facility projects (Retief et al., 2012), conservation status at a national level (NT – Near Threatened; VU – Vulnerable; EN – Endangered) (Barnes, 2000), level of endemism (E – Endemic; BE – Breeding Endemic; NE – Near Endemic), and risk of collision with wind turbines and associated infra-structures.

Full Name	Scientific Name	SA RCLS (Barnes, 2000)	Regional Endemism	Risk of collision	Disturbance / Habitat loss	Habitat preference
Cape Cormorant	*Phalacrocorax capensis*	NT	BE	Moderate	-	-
Great White Pelican	*Pelecanus onocrotalus*	NT	-	High	-	Lakes, estuaries and sheltered bays
African Sacred Ibis	*Threskiornis aethiopicus*	-	-	Moderate	-	Open habitats
White Stork	*Ciconia ciconia*	-	-	High	-	Grassland and fields
Black Stork	*Ciconia nigra*	NT	-	High	-	Lakes, rivers, estuaries and lagoons
Yellow-billed Stork	*Mycteria ibis*	NT	-	High	-	Lakes, rivers and estuaries
Greater Flamingo	*Phoenicopterus roseus*	NT	-	High	-	-
Lesser Flamingo	*Phoeniconaias minor*	NT	-	High	-	-
Cape Vulture	*Gyps coprotheres*	VU	E	High	-	Grassland and arid savannas
Verreaux's Eagle	*Aquila verreauxii*	-	-	High	Moderate	Mountainous areas
Martial Eagle	*Polemaetus bellicosus*	VU	-	High	Moderate	Open habitats
Palm-nut Vulture	*Gypohierax angolensis*	-	-	High	-	Forest, woodland and coastal areas
African Fish Eagle	*Haliaeetus vocifer*	-	-	High	-	Large rivers, lakes, estuaries and lagoons
Pale Chanting Goshawk	*Melierax canorus*	-	NE	Moderate	Moderate	Arid savanna, semi-desert and grassland
African Marsh Harrier	*Circus ranivorus*	VU	-	Moderate	Moderate	Marshes, reedbeds and adjacent grassland
Black Harrier	*Circus maurus*	NT	E	Moderate	Moderate	Grassland and scrub
Lanner Falcon	*Falco biarmicus*	NT	-	High	-	Wide range of open habitats
Lesser Kestrel	*Falco naumanni*	VU	-	Moderate	Moderate	Arid shrubland, grassland and fields
Secretarybird	*Sagittarius serpentarius*	NT	NE	High	Moderate	Savanna and open grassland
Grey-winged Francolin	*Scleroptila africana*	-	E	Moderate	High	Grassland
Blue Crane	*Anthropoides paradiseus*	VU	E	High	Moderate	Grassland and agricultural lands
Denham's Bustard	*Neotis denhami*	VU	-	Moderate	Moderate	Open grassland and agricultural land
Karoo Korhaan	*Eupodotis vigorsii*	-	E	Moderate	Moderate	Grassland and croplands
Southern Black Korhaan	*Afrotis afra*	-	E	Moderate	High	-
Damara Tern	*Sterna balaenarum*	EN	-	Moderate	-	Sheltered coastlines, bays and lagoons
Cape Eagle-Owl	*Bubo capensis*	-	-	Moderate	Moderate	Rocky and mountainous terrain
Spotted Eagle-Owl	*Bubo africanus*	-	-	Moderate	Moderate	Wide range

Overall Bird Community

Through the field surveys conducted in November 2012, and as a result of all the methodologies implemented, a total of 52 bird species were confirmed as occurring in the study area (Wind Energy Facility site and Control area). Most of the species identified are resident in the study area and their populations can be monitored through the whole year.

From the Red Listed bird species referred to earlier, three species were confirmed as being present in the proposed site during field surveys, namely, Blue Crane (*Anthropoides paradiseus*) considered Vulnerable; and Black Harrier (*Circus maurus*) and Agulhas Long-billed Lark (*Certhilauda brevirostris*), considered Near Threatened (Barnes, 2000). From the observed bird species in the study site, a total of 15 bird species are considered endemic and 2 are considered near endemic to the region where the Goereesoe Wind Energy Facility is located (Appendix IV of the bird report- refer to Appendix H of this report).

6.11. Palaeontology Profile

Table 6.5: Fossil record of the main rock units represented in the study area. The palaeontological sensitivity of all the rock units is rated as low to very low. This is often due to high levels of tectonic deformation and chemical weathering (e.g. Bokkeveld Group)

GROUP		FORMATION & AGE	ROCK TYPES	FOSSIL BIOTA	COMMENTS
LATE CAENOZOIC SUPERFICIAL SEDIMENTS		**Alluvial & colluvial gravels, soils, silty alluvium, calcretes** **Neogene - Recent**	Bouldery to pebbly or gravelly alluvial gravels, sands, silts, near-surface calcretes	disarticulated to well-articulated skeletal remains (bones, teeth) or mammals, reptiles (*e.g.* tortoises), ostrich egg shells, freshwater molluscs, crabs, plant remains, trace fossils (*e.g.* rhizoliths, termitaria and other invertebrate burrows, vertebrate tracks), microfossils (*e.g.* pollens, spores, ostracods)	"High Level Gravels" are coarse, often semi-consolidated, ancient fluvial deposits at high elevations above the modern drainage systems. These are often mapped as part of the Grahamstown Formation.
		Grahamstown Formation (Tg) Paleogene (majority) to Neogene	Silcretes & ferricretes - cemented superficial deposits (gravels, sands, muds *etc*) overlying deeply-weathered and silicified bedrock (*saprolite*)	rare fossil plants (*e.g.* reedy *Phragmites*), charophyte algae (stoneworts), invertebrate burrows (*e.g. Skolithos*) occasional derived fossils (*e.g.* silicified wood from the Permian Beaufort Group)	Composite unit incorporating pedocretes of varying ages and origins, often polycyclic in origin (*i.e.* several phases of silica cementation, solution and erosion)
BOKKEVELD GROUP	**BIDOUW SUBGROUP**	**Several poorly differentiated formations (Dbi)** Middle Devonian	Shallow marine to coastal (deltaic / estuarine) wackes and micaceous mudrocks as well as clean-washed tempestite sandstones	Rich, diverse shelly biotas in lowermost part of succession, dominated by trilobites, brachiopods, molluscs and echinoderms *plus* various minor groups. Microfossils within mudrocks (*e.g.* organic-walled	In study area fossil remains have been largely obliterated by intense tectonic deformation and chemical weathering. Bedrock exposure here

GROUP		FORMATION & AGE	ROCK TYPES	FOSSIL BIOTA	COMMENTS
				acritarchs). Upper Bidouw succession (*e.g.* Klipbokkop Fm) with important non-marine fish (sharks, placoderms, acanthodians *etc*), primitive vascular plants (*e.g.* lycopods), non-marine bivalves, trace fossils (especially *Spirophyton*).	very poor due to extensive superficial deposits.
	CERES SUBGROUP	**Several poorly differentiated formations (Dc)** Early – Mid Devonian	Shallow marine wackes ("dirty" sandstones) as well as clean-washed tempestite sandstones, predominantly grey, silty or clay-rich mudrocks	Rich, diverse shelly biotas dominated by trilobites, brachiopods, molluscs and echinoderms plus various minor groups (*e.g.* fish) Primitive vascular plants in some sandstones. Microfossils within mudrocks (*e.g.* organic-walled acritarchs).	In study area fossil remains have been largely obliterated by intense tectonic deformation and chemical weathering. Bedrock exposure here very poor due to extensive superficial deposits.

6.12 Social Characteristics of the Study Area and Surrounds

6.*12.1. Socio-demographic profile of the study area population*

An analysis based on the specified concentric zones suggests that 0,67% of the population residing in the area (i.e. within 40 km of Farm 432 Goereesoe) live within 20 km the site proposed for development. An assessment based on the population groups suggests that ~69% of the population that reside within 40 km of the site are Coloured. The Black African and White population respectively represents 9% and 21% of the total population residing within 40 km of the site.

6.12.2. Population

The population of the study area, i.e. within 40 km of the site proposed for development, was estimated at 47 957 in 2001 (Statistics South Africa, 2003). As indicated, the enumeration areas used in the 1996 and 2001 Census surveys do not correspond and can therefore not be used to estimate the rate of population growth accurately. Table 6.6 provides an indication of the population distribution of residents within 20 km of the site relative to 40 km of the site per population group for 2001.

Table 6.6: Breakdown of the population by population group for the study area (within 20 and 40 km) in 2001

Area	Population Group				Total
	Black African	**Coloured**	**Asian**	**White**	
Population within 20 km of the site	27	202	-	91	320
Relative to population within 40 km	0.63%	0.61%	0.00%	0.88%	0.67%

Source: Statistics South Africa (2003); Municipal Demarcation Board (2003)

The findings suggest that 0,67% of the population within 40 km live within 20 km of the site. An analysis of the breakdown per population groups suggests that Coloureds living within 20 km of the site comprise 0,61% of the total Coloured population within 40 km. The proportion of Black African and White people is 0,63% and 0,88%, respectively.

6.12.3. Employment and skills levels

A perspective of employment for the different zones in the municipal area is provided in Table 6.7 with specific reference to the number of employed, unemployed and not-economically active persons per population group.

Table 6.7 indicates that 53,95% of the total population residing within 40 km of the site are employed, while unemployment is estimated at 9,72%. The proportion of employed

for the White and Coloured groups are 57,38% and 53,08% of the total population group, respectively.

Table 6.7: An assessment of employment by population group for 2001[8] based on specified radii from the site proposed for development

Swellendam: Within 20 km					
Category of employment	**Black African**	**Coloured**	**Indian/ Asian**	**White**	**Grand Total**
Employed	15	97	0	30	142
Unemployed	0	6	0	0	6
Not economically active	9	24	0	30	63
Total	**24**	**127**	**0**	**60**	**211**
Dependency ratio per population group	1.67	3.23	0.00	1.00	2.06
Swellendam: Within 40 km					
Category of employment	**Black African**	**Coloured**	**Indian/ Asian**	**White**	**Grand Total**
Employed	1 534	11 378	15	3 932	16 859
Unemployed	515	2 354	12	156	3 037
Not economically active	857	7 704	27	2 765	11 353
Total	**2 906**	**21 436**	**54**	**6 853**	**31 249**
Dependency ratio per population group	1.12	1.13	0.38	1.35	1.17

Source: Statistics South Africa (2003)

An assessment of the dependency ratios for the zones is based on the premise that for each person who is employed, a factor of people is unemployed or economically inactive. The findings of the research for each of the zones suggest a dependency ratio of 3,23 and 1,13 for Coloured residents within 20 km and 40 km, respectively. This implies that every employed resident could support one unemployed or economically inactive person within 40 km of the site. The ratio for the White population group within 20 km and 40 km of the site is 1,00 and 1,35, respectively.

6.12.4. Household Incomes

Table 6.8 provides the income ranges for households as defined by the specified radii from the centre of the site proposed for the development. Note that not all the respondents disclosed their income. Of those that did disclose their income, 6,25% of the households within 20 km of the development do not have an income, while 5,16% of households within 40 km of the site have no income. Furthermore, 29,79% of the households within 40 km of the development declared an income of R19 200 or less (excluding households with no income).

[8] The information from Census 2011 was released in November 2012. However, due to time constraints this data was not used in the report. Therefore, it should be noted that the 2001 Census data is dated. Where possible this data has been up-dated.

The findings suggest that more than 80,61% of the households that declared an income and reside within 40 km of the site, have an annual income of less than R76 801. The same proportional findings for households within 20 km indicates a percentage of 90,22%.

Table 6.8: Distribution of annual household income for each specified zone in 2001

Income category	Within 20 km		Within 40 km	
No income	6	6.52%	672	5.16%
R1 - R4 800	-	0.00%	510	3.91%
R4 801 - R 9 600	21	22.83%	2 257	17.31%
R9 601 - R 19 200	22	23.91%	3 116	23.90%
R19 201 – R 38 400	19	20.65%	2 815	21.60%
R38 401 – R 76 800	21	22.83%	1 810	13.89%
R76 801 – R153 600	3	3.26%	1 190	9.13%
R153 601 - R307 200	-	0.00%	457	3.51%
R307 201 - R614 400	-	0.00%	115	0.88%
R614 401 - R1 228 800	-	0.00%	42	0.32%
R1 228 801 - R2 457 600	-	0.00%	33	0.25%
R2 457 601 and more	-	0.00%	18	0.14%
Grand Total	92	100.00 %	13 035	100.00 %

Source: Adapted from Statistics South Africa (2003)

SCOPE OF THE WIND ENERGY FACILITY PROJECT CHAPTER 7

This chapter provides details regarding the scope of the proposed Goereesoe Wind Energy Facility, including all required components of the project and necessary steps for the project to be developed.

7.1 Project Construction Phase

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. A construction workforce will be required. Approximately 60 employment opportunities would be created during the construction phase. As far as possible, local labour will be utilised. The construction phase is anticipated to be ~ 12 months in duration.

7.1.1 Dimensions of Components

The infrastructure required will have the following typical dimensions:

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (maximum of 100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which lies on the south west boundary of the site, and crosses the north west corner of the site. Two on site substation and power line options are being considered and assessed in the EIA.
    - Option A, adjacent to the north of the proposed turbine 1 (Length of proposed power line: 1400.3m).
    - Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line (Length of proposed power line: 23.6m).

Figure 7.1 illustrates the approximate extent of the wind turbine construction area.

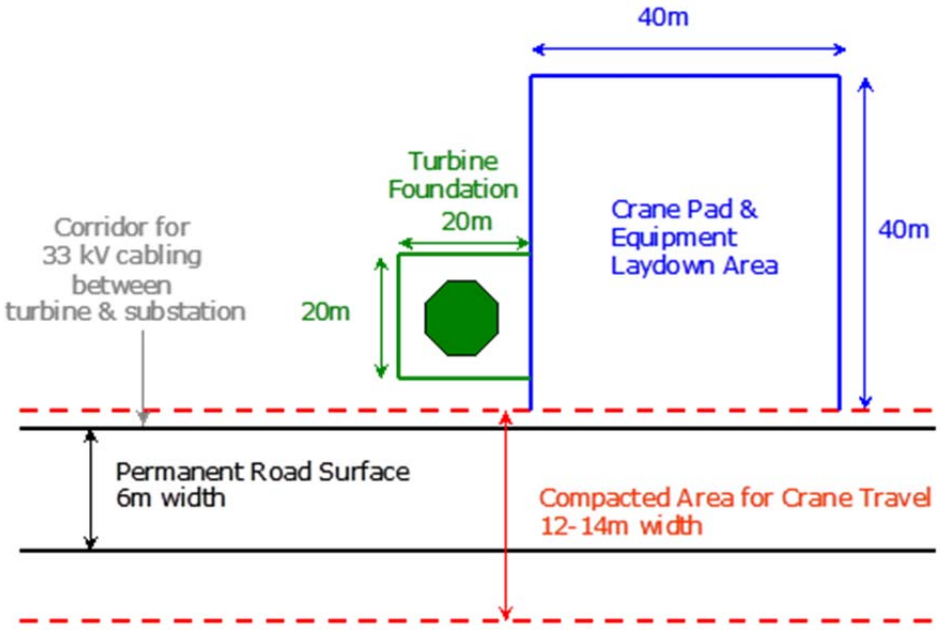

Figure 7.1: Diagrammatic representation of a typical layout of components.

7.2 Activities Associated with Construction of the Wind Energy Facility

Table 7.1 highlights the main activities associated with construction of the wind energy facility.

Table 7.1: Activities Associated with Construction of the Wind Energy Facility

Main Activity / Project Component	Components of Activity	Details
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey and confirmation of the infrastructure micro-siting footprint; » Survey of substation sites; and » Survey of power line servitudes to determine tower locations.	» All surveys are to be undertaken prior to initiating construction.
Establishment of access roads	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). » Temporary access roads will be up to 10 m wide in some places due to turning circles that are required. » Establish internal access roads: up to 5 m wide permanent roadway within the site between the turbines for use during construction and operation phase.	» Access to the site is currently possible via existing farm accesses along Main Road (MR) 264 at 5 different points. The recommended access to the site is via the existing Goereesoe Farm accesses off the R319 which diverts toward the south from the N2, approximately 11km south west of Swellendam. » Access roads will be constructed/upgraded 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. » Existing access roads to the site will be utilised, and upgraded where required. 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 is informed by the final micro-siting/positioning of the wind turbines (as well as specialist surveys). » To accommodate the large crawler crane required for turbine assembly, a track of up to 11 m in width is required to be established on the site (as advised to be required by the developer).

Main Activity/Project Component	Components of Activity	Details
Undertake site preparation	» Site establishment of offices / workshop with ablutions and stores and contractors' yards. » Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the footprint of each turbine » Excavations for foundations	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.
Establishment of laydown areas on site	» Laydown areas at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area for crane assembly.	» Each turbine needs a flat and hardened lay down area of ~1 600 m^2 during the construction process. » The lay down area will need to accommodate the cranes required in tower/turbine assembly. » Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. » A large lay down area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas. » If laydown areas are not required during operation, these areas will need to be rehabilitated after construction.
Construct wind turbine foundations	» Concrete foundations of approximately up to 20 m x 20 m x 4 m depth at each turbine location (final dimensions to be defined by geotechnical survey of the site).	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities.

Main Activity / Project Component	Components of Activity	Details
		» Concrete may to be brought to site as ready-mix or batched on site if no suitable concrete suppliers are available in the vicinity. The reinforced concrete foundation will be poured and will support a mounting ring. The foundation will then be left for up to a week to cure.
Transport of components and equipment to site	» Flatbed trucks will be used to transport the majority of components to sit from the nearest port (Cape Town). * Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades (rotor diameter of up to 112 m). * Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and main lift crawler crane) to erect the wind turbines. * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment etc.). * The components required for the establishment of the substation (including transformers) * Components required for the establishment of the on-site substation (transformers) and power line (including towers and cabling) * Ready-mix cement trucks for turbine	» Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines. Other components include components required for the establishment of the substation (including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine, including tower, will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.), and protection of road-related structures (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 routes, and the dedicated access/haul road to the

Main Activity / Project Component	Components of Activity	Details
	and substation foundations	site itself.
Erect turbines	» Large lifting crane used for lifting of large, heavy components » A crane for the assembly of the rotor	» The large lifting crane 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 rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground. It will then be lifted to the nacelle and bolted in place. » It will take approximately 2 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.
Construct substation and associated ancillary infrastructure.	» Substation and associated components; » Security fencing around high-voltage (HV) yard; and » An operations and maintenance building, including a workshop building, is proposed. Some of the existing on-site buildings may be utilised where practical.	» A temporary construction area is needed for containers, toilets, and equipment. » Permanent operational buildings are as follows: * Operations and maintenance facility, including a storage building (100m x 100m), 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. » The on-site substation will be constructed with a HV yard footprint of up to 100 m x 100 m. » The substation would be constructed as follows: * Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment (including transformers)

Main Activity / Project Component	Components of Activity	Details
		* Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of the wind turbines to the on-site substation	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substation.	» 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 would follow the internal access roads as far as reasonably possible.
Connect substation to power grid	» A new overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which crosses the north-west corner of the site	» The route for the power line will be surveyed, and pegged prior to construction. » A servitude of approximately 22 m will be required for the power line.
Commissioning of the facility	» Start up for electricity generation	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site rehabilitation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

7.3 Project Operation Phase

An artist's impression of a typical wind energy facility, illustrating the various components and associated infrastructure is shown in Figure 7.2. Based on information from other proposed wind energy facilities, the establishment of a wind energy facility will create approximately 10 employment opportunities. It is anticipated that there could be security and maintenance staff required on site. The wind turbines will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions or maintenance activities. Table 7.2 highlights the main activities associated with operation of the wind energy facility.

Table 7.2: Activities Associated with Operation of the Wind Energy Facility

Main Activity / Project Component	Components of Activity	Details
Operation	» Operation of the wind turbines	» Once operational, the Wind Energy Facility will be monitored remotely. » It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities.
Maintenance	Maintenance activities include: » Oil and grease – turbines; » Transformer oil – substation; and » Waste product disposal » Cleaning of turbines	» The wind turbines will be subject to periodic maintenance and inspection. » Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 25 - 30 years, with maintenance.

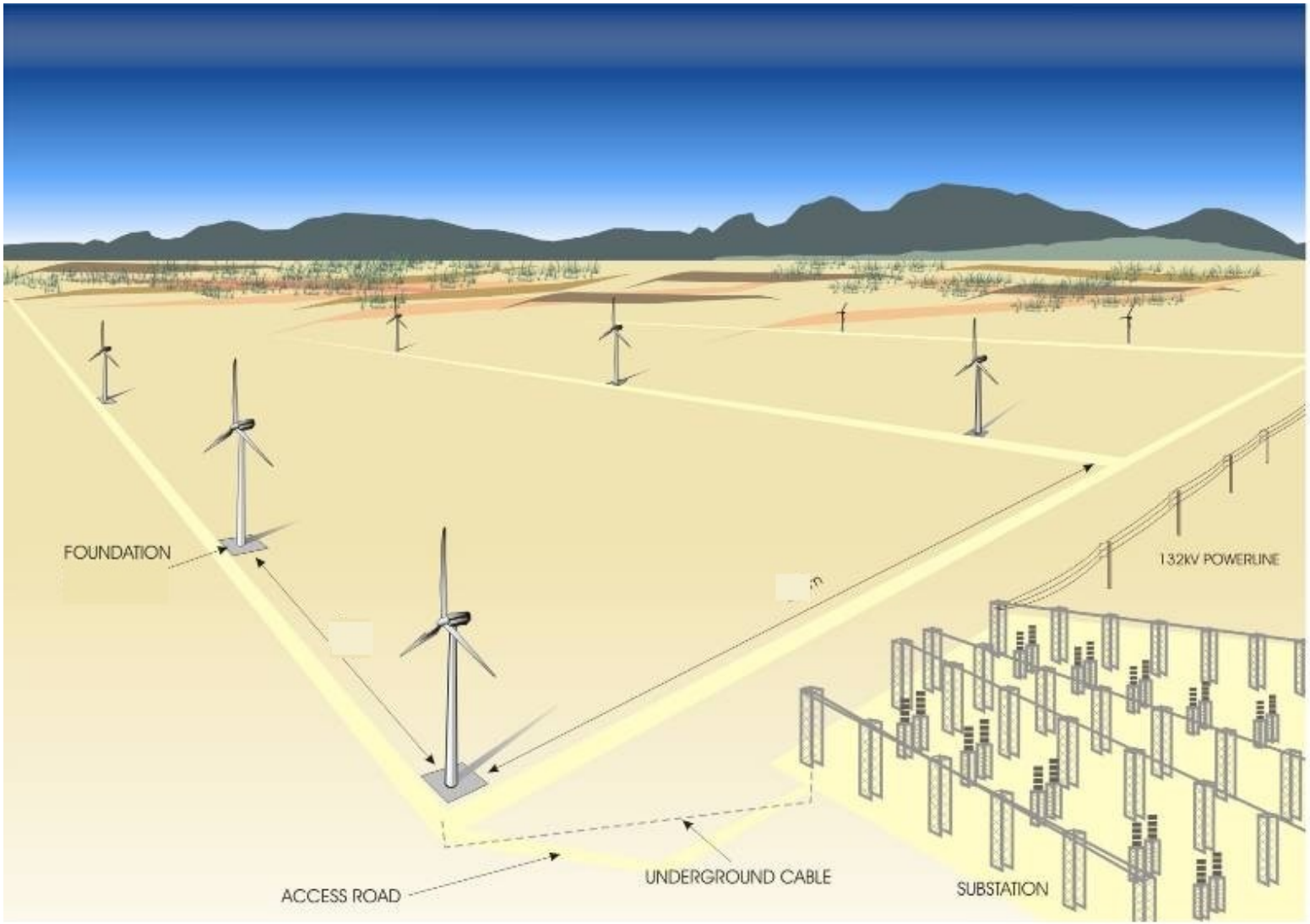

Figure 7.2: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure (note that distances and dimensions are indicative and will depend on the site-specific conditions, wind resource and turbine selected for implementation)

7.4 Decommissioning

The turbine infrastructure which will be utilised for the proposed project is expected to have a lifespan of approximately 20 - 30 years (with maintenance). Generally a power purchase agreement (PPA) of 20 years is signed with the energy buyer (i.e. Eskom). After the PPA comes to an end, a new PPA may be signed at terms that are financially viable at that point in time. The PPA may be based on a shorter term agreement using the existing turbines (if the existing turbines are still suitable) or a new longer term PPA may be negotiated based on re powering (refurbishment) of the wind farm. It is most likely that refurbishment of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time. New turbine technology may also reduce potential environmental impacts. Where no new PPA can be negotiated it is likely that the wind farm will be decommissioned as required in the EMP. The following decommissioning and/or repowering activities have been considered to form part of the project scope of the proposed wind energy facility.

Table 7.3: Activities Associated with Decommissioning of the Wind Energy Facility

Main Activity / Project Component	Components of Activity	Details
Site preparation	» 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) » Mobilisation of construction equipment	» 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 would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.
Disassemble wind turbines	» A large crane will be used to disassemble the turbine and tower sections. » The turbines will be disassembled and removed.	» Turbine components would be reused, recycled, or disposed of in accordance with regulatory requirements.

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY & POWER LINE CHAPTER 8

Environmental impacts associated with the proposed Goereesoe Wind Energy Facility are expected to be associated with the construction, operation and decommissioning of the facility. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction of a wind energy facility project includes 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 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 barotrauma; 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/s 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 Programme (refer to Appendix Q).

In order to assess the impacts associated with the proposed Goereesoe 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. The study area for the Goereesoe site (approximately ~1 315 ha) is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated in **Figure 8.1** below, and includes Portions 0, 2, 4 and 5 of Farm 432 Goereesoe.

The project will include the following infrastructure:

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal/ access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (maximum of 100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which lies on the south western boundary of the site, and crosses the north western corner of the site. Two options are being considered and assessed in the EIA.
    - Option A, adjacent to the north of the proposed turbine 1 (Length of proposed power line: 1400.3m).

The assessment presented within this chapter of the report is on the basis of a facility layout provided by INCA Energy. This layout indicates **13 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies attached within **Appendices F – O**) considers the potential impacts.

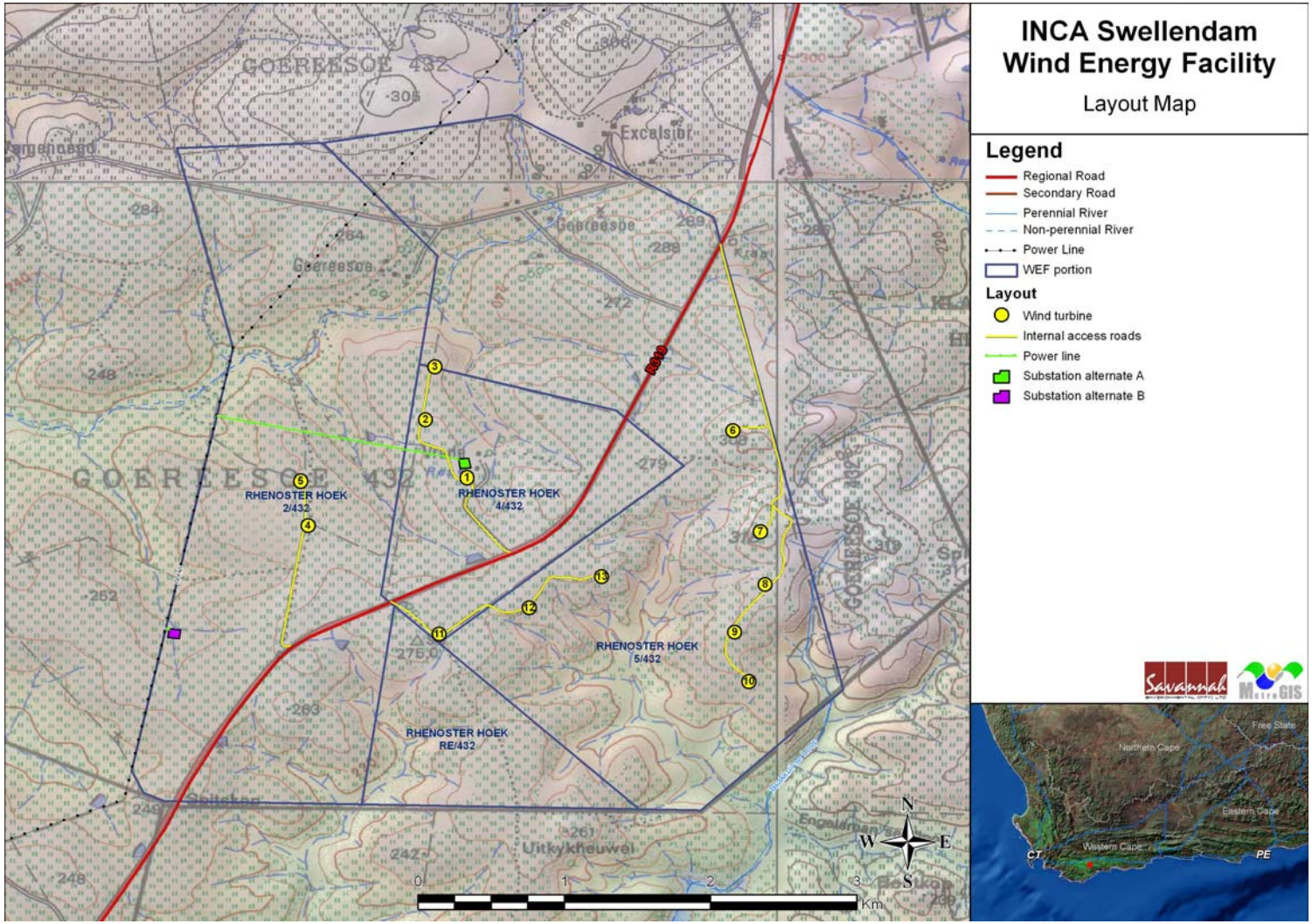

Figure 8.1: Layout map showing the technical design and layout of the Goereesoe Wind Energy Facility

Other similar developments in the study area

The cumulative impacts associated with the proposed INCA Swellendam Wind Energy Facility are largely linked to the following projects in proximity to the proposed project (Refer to Figure 8.2.):

Table 8.1: Table indicating other Wind Energy Facilities and distance from the proposed Goereesoe Wind Energy Facility

DEA ref	Project Title	Applicant	Location/Property	Capacity (MW)	EIA Status	Distance from proposed Development
12/12/20/1798	Proposed wind energy facility at Uitkyk/Excelsior near Swellendam	Biotherm Energy (Pty) Ltd	Farm Uitkyk RE/434; Farm Excelsior 432 portion 6; Farm Vryheid 435 portion 0; Farm Klaas Kaffer Heuwel 438 portion 1	143	EA issued October 2011	~5 km north east
12/12/20/1815	Proposed Innowind wind energy facility near Swellendam,	InnoWind (Pty) Ltd	Farms Vryheid and Kluitjieskraal) 34˚ 09' 34" S by 20˚ 18' 14" E)	30	EA issued November 2011	~15.5 km to the North East
12/12/20/1746	Klipheuwel/Dassiesfontein wind energy facility in the Overberg near Boontjieskraal	Biotherm Energy (Pty) Ltd	Farm Klipheuval 410 portion 8; Farm Alias Kruis Vley 410 portion 10; Farm Boontjieskraal 417 portion 0; Fram 418 remaining extent; Farm Kilp Heuvel 410 portion 5; Farm 410 remainning extent of portion 9; Farm Heuweltjieskraal portion of Pampoenkraal 843; Farm Dassiesfontein portion 1 remaining extent of Huveltjies Kraal 426	100	EA issued July 2011 (Preferred Bidder status received for 26 MW)	~ 76km to the west
12/12/20/2569	Proposed Denhami wind energy facility near Struisbaai	Denhami Research Farms CC	Farm Brak Fontein B284	20	Awaiting EA	~65km south south east

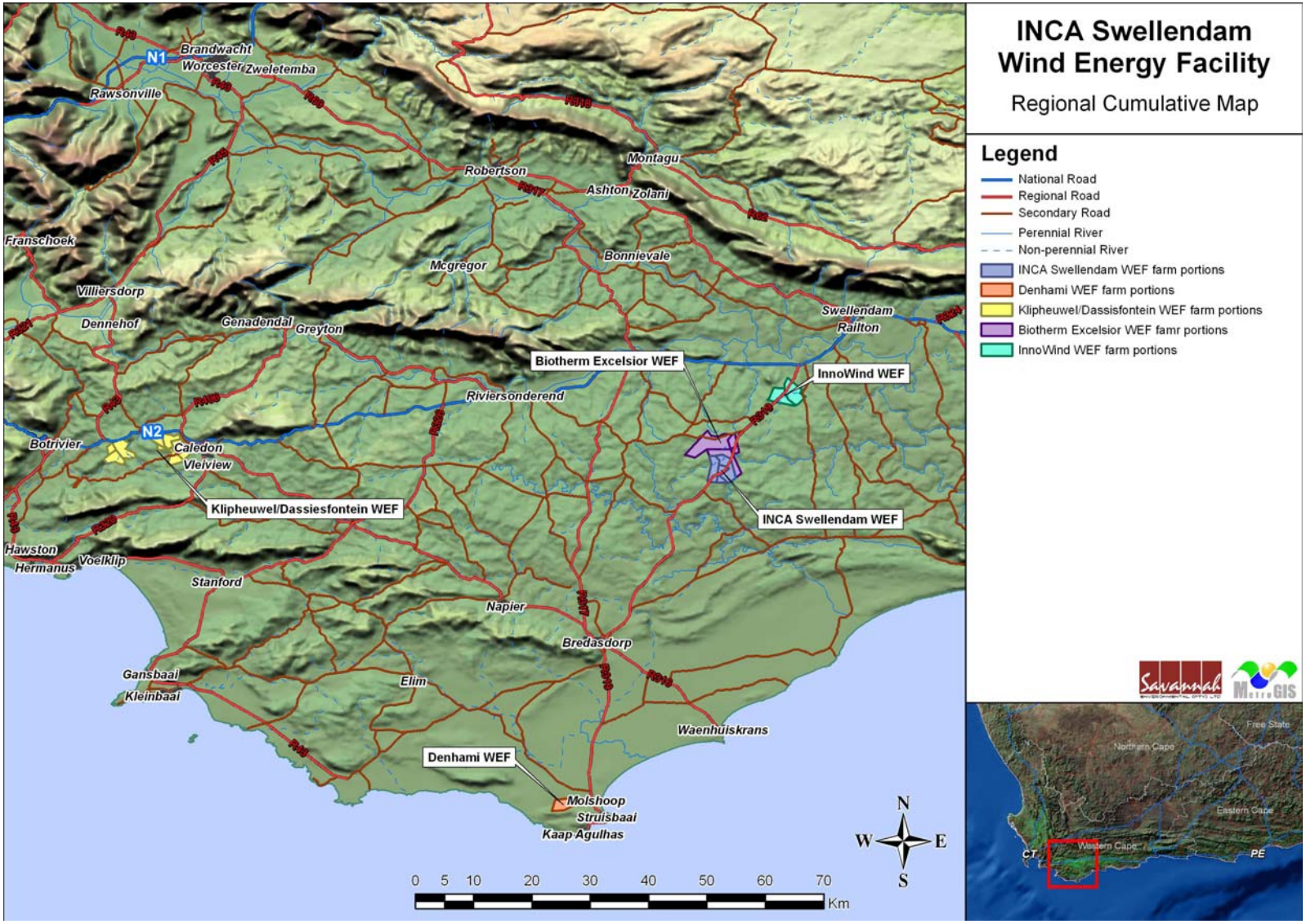

Figure 8.2: Map showing the cumulative impacts Goereesoe Wind Energy Facility

8.1 Assessment of Potential Impacts on Flora

The 'source of impacts' are grouped into two groups based on how they will affect the vegetation and ecology: (a) wind turbines, transformers and construction hard-standing areas (b) internal access roads and underground cabling and overhead power line.

Three principal direct impacts are assessed:

» Loss of vegetation: Eastern Rûens Shale Renosterveld (including the constituent plant species and the habitat created by the plant communities).
» Loss of vegetation: Rûens Silcrete Renosterveld (including the constituent plant species and the habitat created by the plant communities).
» Loss of ecological processes, e.g. pollination and seed dispersal which may occur due to construction or operational impacts.

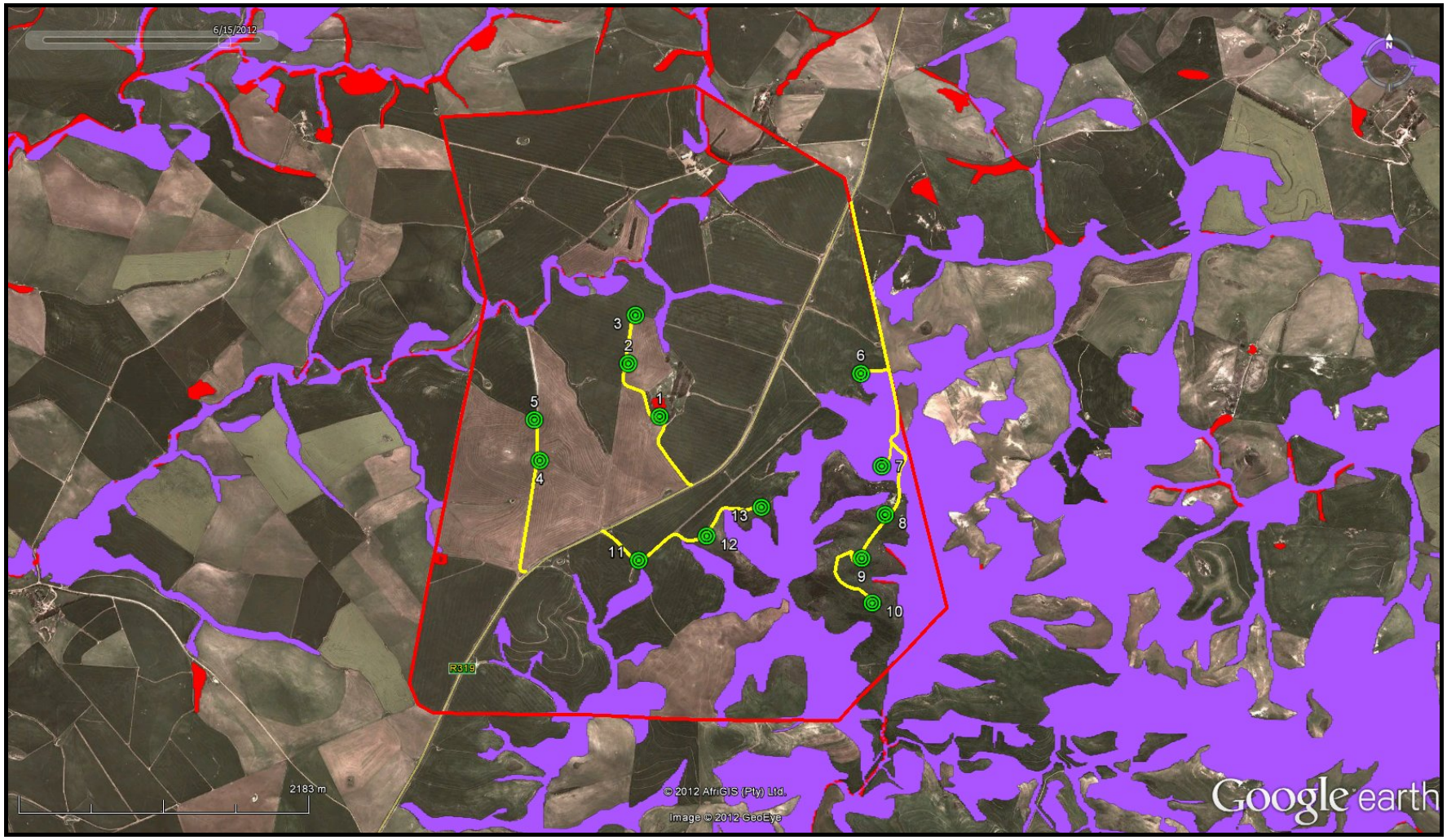

Figure 8.3: Critical Biodiversity Areas (purple) and Ecological Support Areas (red) at Goereesoe Farm (red boundary) for the proposed layout as indicated (turbines (green dots) and access roads (yellow lines))

Impact Tables summarising Flora impacts

Nature: Loss of Eastern Rûens Shale Renosterveld vegetation due to construction of wind turbines, transformers and construction of lay-down areas.

Construction of wind-turbines at Goereesoe Farm would result in a large amount of disturbance at each local wind turbine site. The topsoil would be stripped and excavated over an area of 400 m^2 for each turbine foundation and 1600 m^2 for each hard-standing area (2 ha per turbine site). This would amount to at least 24 ha of disturbance, not all concentrated in one area but scattered as per the turbine layout.

Owing to the almost non-existent presence of Eastern Rûens Shale Renosterveld on site as a result of intensive agriculture, the anticipated impact of the proposed turbines and associated lay-down areas in terms of loss of this vegetation type would be Low negative without and with mitigation.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	No. Eastern Rûens Shale Renosterveld is Critically Endangered and therefore any loss is considered of importance. However, no further loss is anticipated due to this project.	
Can impacts be mitigated	Not required	

Mitigation:
No mitigation would be required since no Eastern Rûens Shale Renosterveld would be lost at Turbine sites 1–13 or at Substation Alternative A or Alternative B.

Cumulative impacts:
The wind energy facility would be localised to Goereesoe Farm. Other wind energy facilities could be planned for the Overberg District in future and may target sensitive areas of Eastern Rûens Shale Renosterveld.

Residual impacts[9]:
Considering that the most important mitigation from a botanical perspective would be to avoid and sites with natural vegetation, an assuming that this would happen, residual impacts would be very low.

[9] Definition: Residual impact -- Potential impact remaining after mitigation measures have been adopted into a project, (*Dougherty and Wall, 1995).*

Nature: Loss of Eastern Rûens Shale Renosterveld vegetation due to construction and operation use of access roads, laying of underground cables and construction of overhead power line.

The construction of access roads, laying of underground cables and construction of overhead power lines in the areas where Eastern Rûens Shale Renosterveld would have occurred would also have a Low negative impact without and with mitigation.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	No. Eastern Rûens Shale Renosterveld is Critically Endangered and therefore any loss is considered of importance. However, no further loss is anticipated due to this project.	
Can impacts be mitigated	Not required	

Mitigation:
No mitigation would be required since no Eastern Rûens Shale Renosterveld would be lost along access and cable routes to Turbine sites 1–13 or along power line routes.

Cumulative impacts:
The wind energy facility would be localised to Goereesoe Farm. Other wind energy facilities could be planned for the Overberg District in future and may target sensitive areas of Eastern Rûens Shale Renosterveld.

Residual impacts:
Considering that the most important mitigation from a botanical perspective would be to avoid and sites with natural vegetation, an assuming that this would happen, residual impacts would be very low.

Nature: Loss of Rûens Silcrete Renosterveld vegetation due to construction of wind turbines, transformers and construction lay-down areas.

Rûens Silcrete Renosterveld occurs on isolated koppies which are not arable and have consequently not been ploughed although they are grazed by livestock. The result is that important remnants of high botanical sensitivity (threatened and endemic species) occur on these silcrete koppies. In the past the koppies were ecologically connected by the presence of shale renosterveld between them. They are now isolated in a 'sea' of agricultural lands

and hence are a vital habitat for strongly site-specific species. The silcrete outcrops are also more resistant to erosion than shale and so are prominent in the landscape. They therefore provide ideal 'high' sites for location of wind turbines. A conflict thus exists between selection of silcrete koppies for wind turbines and the high botanical and ecological sensitivity of these sites.

The two sites where Rûens Silcrete Renosterveld occurs are at the Turbine 6 and 7 locations. Both of these turbines would be located within a Critical Biodiversity Area. The anticipated impact of the proposed turbines and associated lay-down areas in terms of loss of Rûens Silcrete Renosterveld would thus be High negative at the above sites without mitigation. Mitigation should be avoidance of these sites and if this is achieved the possible impacts would be avoided.

	Without mitigation	***With mitigation***
Extent	Local (2)	There would be no need for other mitigation if the construction in sensitive areas is AVOIDED.
Duration	Long-term (4)	
Magnitude	High (8)	
Probability	Definite (5)	
Significance	**High (70)**	
Status (positive or negative)	Negative	
Reversibility	Not reversible	
Irreplaceable loss of resources	Yes. Rûens Silcrete Renosterveld is Critically Endangered therefore any loss is considered of great importance.	
Can impacts be mitigated	Only if Turbine sites 6 & 7 are completely avoided.	

Mitigation:
Avoid placement of turbines and other infrastructure within Rûens Silcrete Renosterveld

Cumulative impacts:
The wind energy facility would be localised to Goereesoe Farm. Other wind energy facilities could be planned for the Overberg District in future and may target sensitive areas of Rûens Silcrete Renosterveld.

Residual impacts:
Low negative – possible loss of natural vegetation.

Nature: Loss of Rûens Silcrete Renosterveld vegetation due to construction and operation use of access roads, laying of underground cables and construction of overhead power line.

The construction of access roads, laying of underground cables and construction of the overhead power line in the areas where Rûens Silcrete Renosterveld occurs would also have a High negative impact without mitigation and Medium negative impact with mitigation.

Any internal road network through Rûens Silcrete Renosterveld would require careful

maintenance to prevent erosion of the slopes. Roads that are not correctly drained and maintained could result in gulley erosion. Any roads that are built will make a permanent impression on the landscape and will not be readily remediated.

Underground cables where required should be laid alongside internal access roads to limit the requirement for additional trenches. Their impact would then be 'contained' within the impact caused by the roads.

	Without mitigation	***With mitigation***
Extent	Local (2)	There would be no need for other mitigation if the construction in sensitive areas is AVOIDED.
Duration	Long-term (4)	
Magnitude	High (8)	
Probability	Definite (5)	
Significance	**High (70)**	
Status (positive or negative)	Negative	
Reversibility	Not reversible	
Irreplaceable loss of resources	Yes. Rûens Silcrete Renosterveld is Critically Endangered therefore any loss is considered of great importance.	
Can impacts be mitigated	Only if access roads, cable routes and / or transmission lines do not impact any Rûens Silcrete Renosterveld.	

Mitigation:
Avoid placement of infrastructure within Rûens Silcrete Renosterveld.

Cumulative impacts:
The wind energy facility would be localised to Goereesoe Farm. Other wind energy facilities could be planned for the Overberg District in future and may target sensitive areas of Rûens Silcrete Renosterveld.

Residual impacts:
Low negative – possible loss of some natural vegetation

Nature: Loss of ecological processes due to construction of wind turbines, transformers, construction lay-down areas and cable laying in Eastern Rûens Shale Renosterveld.

Owing to the extremely high level of transformation of habitat in the areas of Eastern Rûens Shale Renosterveld targeted for Turbines 1 – 5 and 8 – 13, ecological processes have already been significantly negatively altered. Anticipated impacts on the ecology of these habitats would be Low negative without and with mitigation.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (2)

Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	High (2)
Probability	Definite (5)	Definite (5)
Significance	Low(40)	Low (40)
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes
Mitigation: Prevent introduction of alien organisms through development and implementation of an alien plant management plan		
Cumulative impacts: Negligible because the ecology has already been significantly compromised.		
Residual impacts: Low negative – There may be impacts on small areas of natural veld.		

Nature: Loss of ecological processes due to construction of wind turbines, transformers, construction lay-down areas and cable laying in Rûens Silcrete Renosterveld.

Despite the fragmented nature of the Rûens Silcrete Renosterveld in the study area ecological processes are probably still functional since these islands offer natural habitat not only for threatened and endemic plants but also for birds, insects, chameleons, mole-rats etc. Impacts on the ecology of the silcrete renosterveld habitat due to disturbance by any construction activities would be High negative without mitigation and Moderate negative with mitigation.

	Without mitigation	***With mitigation***
Extent	Local (2)	There would be no need for other mitigation if the construction in sensitive areas is AVOIDED.
Duration	Long-term (4)	
Magnitude	High (8)	
Probability	Definite (5)	
Significance	**High (70)**	
Status (positive or negative)	Negative	
Reversibility	Not reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Low possibility unless construction completely avoids Rûens Silcrete Renosterveld.	
Mitigation: Find alternative sites for Turbines 6 & 7 which would then mean that Rûens Silcrete Renosterveld can be completely avoided.		

Cumulative impacts:
Loss of ecological systems particular to Rûens Silcrete Renosterveld
Residual impacts:
If mitigation is applied to avoid Eastern Rûens Shale Renosterveld then the residual impacts will be very low concerning this vegetation type.

8.1.1 Comparative Assessment of Substation and Power Line Alternatives

Proposed substation alternative B location should be considered more favourable than alternative location A as it is closer to the power line grid connection and will contribute to significantly reduce the total length of any aerial overhead power line. From a botanical perspective they would have a similar impact i.e. Low Negative.

8.1.2 Cumulative impacts

Cumulative impacts that could result from the proposed wind energy facility are outlined in tables above. The major cumulative impact would be the contribution to loss of Rûens Silcrete Renosterveld which harbours many endemic and threatened species. This would result from on-site construction activities as well as possibly from the construction of the power line across sensitive vegetation. Any loss of Rûens Silcrete Renosterveld or impact on this Critically Endangered vegetation type in any part of its range would have negative cumulative effects.

8.1.3 Conclusions and Recommendations

The proposed Goereesoe Wind Farm near Swellendam would be located mainly in areas of low ecological and botanical sensitivity (Low negative impacts) but partly in areas of high ecological and botanical sensitivity (High negative impacts). In the latter case, loss of Critically Endangered Rûens Silcrete Renosterveld would be unacceptable and can be mitigated by avoidance, i.e. relocating the proposed Turbines 6 & 7 to locations where this important vegetation type is not found. Cables and roads should also avoid areas of Endangered Rûens Silcrete Renosterveld. Alternative sites for these turbines and associated infrastructure must be determined to reduce the impacts from potentially High negative to Low negative. If the recommended mitigation measures are implemented the proposed Goereesoe Wind Farm would be botanically acceptable. (Note: This investigation is strictly applied to the botany of the study area and does not indicate that other ecological considerations could have contradictory implications).

Mitigation of impacts in areas where Eastern Rûens Shale Renosterveld formerly occurred would not be a high priority since this vegetation has largely been lost in the study area on Goereesoe Farm. Mitigation measures should always be borne in

mind and those that should be implemented as general good practice include the following:

» Strict control of impacts to ensure that they are contained within the footprint of the proposed wind turbine and hard-standing areas.
» All construction, concrete batching etc. must take place in designated construction areas.
» There should be no random traversing of any natural vegetation off designated construction areas and roads.
» Fire-hazard protection (no open flames near vegetation) must be in place at construction sites, together with fire-control equipment.
» All solid and liquid waste must be removed from the construction areas and not discarded on the site.
» Any areas that can be restored after construction must be actively rehabilitated under the direction of a qualified restoration practitioner.
» An important objective should be to reduce negative edge effects.
» Any building materials brought onto site would require monitoring for propagules of invasive plant species.
» Monitoring of the introduction of alien invasive plant and insect species must be carried out and infestations contained and eradicated.

In the case of Eastern Rûens Silcrete Renosterveld the principal mitigation measure would be avoidance, i.e. selection of alternative sites for Turbines 6 & 7, and alternative access and cable routes to the proposed sites for Turbines 8 – 10 should this not follow existing roads. It must be ensured that there is no impact on Rûens Silcrete Renosterveld.

8.2 Assessment of Potential Impacts on Fauna and Sensitive Habitats

Potential faunal and ecological impacts resulting from the development of the wind energy facility would stem from a variety of different activities and risk factors associated with the construction and operational phases of the project including the following:

Construction Phase
» Vegetation clearing & site preparation
» Operation of heavy machinery at the site
» Human presence

Operational Phase
» Site maintenance activities
» Human presence
» Operation of the turbines

The above activities are likely to manifest themselves as the following faunal impacts:

» Habitat loss and degradation for fauna
» Reduced landscape connectivity for fauna
» Direct faunal impacts

Site sensitivity

The ecological sensitivity map for the site is depicted below (Figure 8.4). Turbines within areas of potential concern are turbines 6-10. Turbines 12 and 13 are located on the margin of the intact area and according to the locations provided fall on the cleared area maintained between the intact vegetation and cultivated fields. As previously discussed, turbines 8-10 are within an area that has previously been ploughed and the direct impacts on biodiversity are not likely to be a significant concern. The major issue regarding these turbines would be the potential impact on broad-scale ecological processes and the potential disruption of landscape connectivity. Turbines 6 and 7 are within natural vegetation that is not highly degraded and which is classified as being of Very High Sensitivity, as well as being within Critical Biodiversity Areas. This area has also been identified as being botanically important. It would take minor adjustment of turbine 6 to avoid the sensitive area, which could be achieved through moving the turbine about 30m to the north so that it is placed on the margin of the transformed area. It is important to note in this regard that the service and lay down area for the turbine should be located within the transformed habitat and not within the adjacent sensitive natural vegetation. Turbine 7 is however deeper within a sensitive area which could not be avoided through simple micrositing. Given the abundance of less sensitive areas at the site, it is recommended that turbine 7 be relocated to an adjacent less sensitive area such as the previously ploughed area to the south and southeast. This recommendation is based on the proviso that that this area is also botanically acceptable. Provided that these recommendations can be followed, then the development is not likely to have a significant impact on the important faunal habitats at the site and the overall impact on fauna would be low.

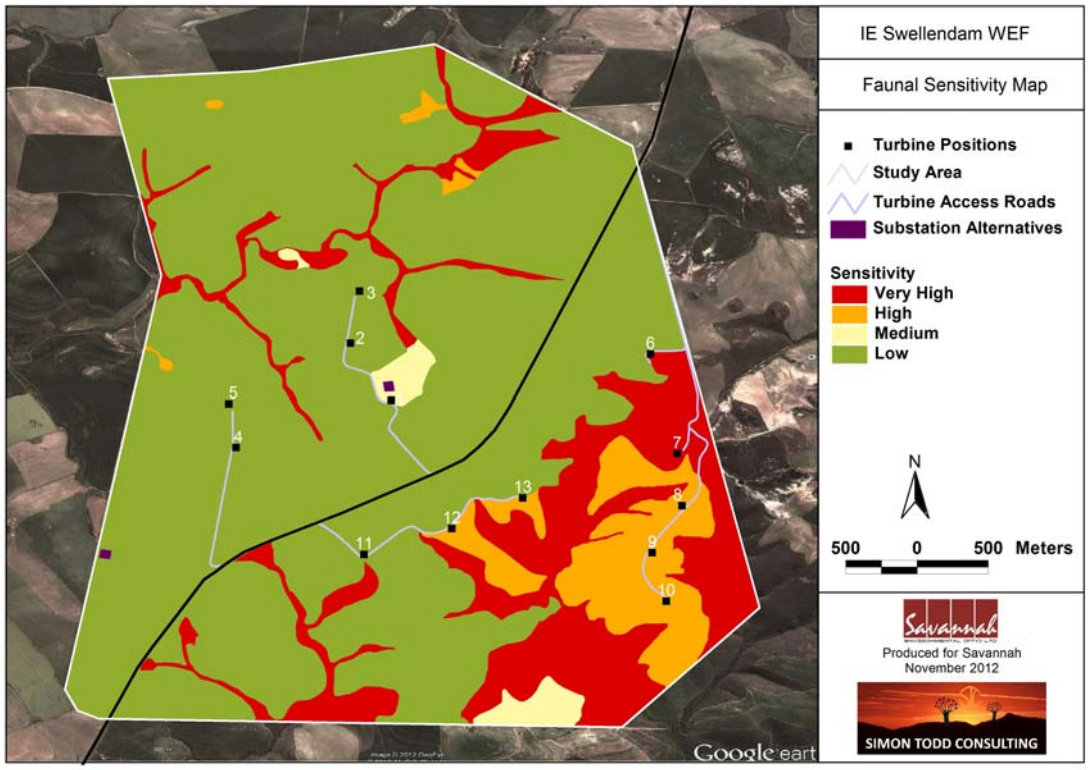

Figure 8.4: Map showing Ecological Sensitivity map of the proposed Swellendam Wind Energy Facility.

Habitat loss and degradation of habitat for fauna

The development of the wind energy facility will result in the loss of habitat for resident fauna. The turbines and associated laydown areas will require approximately 2 ha per turbine site, while the access roads will require about 8 ha. The majority of infrastructure will however be within transformed areas and if the two turbines 6 and 7, which are located in an area of high sensitivity, are moved to adjacent less sensitive areas, then the actual direct loss of habitat would be minimal. The presence of the turbines, the noise generated during their operation and increased activity levels at the site would however amount to habitat degradation for some species. Some mammals are known to increase their vigilance levels in response to increased background noise, which reduces the amount of time available for other activities. The ultimate effect of this is to reduce the quality of the habitat within the affected areas. As the noise from the turbines can extend some distance, this can impact a broad area in the vicinity of the turbines. Although many animals exhibit behavioural changes to counter this impact, species which use noise to locate their prey, avoid predators, or communicate may still be impacted.

Should the disturbance at the site result in increased erosion and sedimentation of waterbodies and drainage lines, then this would also amount to habitat degradation for the affected aquatic species but also for any other dependent species.

Reduced Landscape Connectivity

Under most circumstances, the access roads required for wind energy facilities are the major impact source in terms of habitat loss and reduced landscape connectivity. However, the current site is already heavily impacted by transformation, and the access roads would contribute very little to the further disruption of landscape connectivity. Within the area of turbines 7-10 where some vegetation recovery has taken place, some impact on habitat connectivity may occur. Species particularly vulnerable to such impact includes tortoises, snakes and other slow-moving fauna which may be vulnerable to predation when traversing open areas such as roads. The movement and noise generated by the turbines may also deter certain wary species or unhabituated individuals from the area. Although the impact at any particular time may be low, this is a persistent impact that may become more significant over time on account of the cumulative impact generated.

Direct Faunal Impacts

Some smaller animals would not be able to move away from construction activity sufficiently quickly during construction and would be killed by vehicles and earth-moving machinery. In addition, the presence of a large work force on the site would pose a risk to species such as snakes, tortoises and mammals which would be vulnerable to poaching for food, trade or killed out of fear and superstition.

Impact tables summarising potential impacts on fauna that may arise from the construction phase

Impact Nature: Habitat loss and degradation will have a negative effect on resident fauna.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (7)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	High (70)	Low (27)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Without avoidance, the impacts to Critically Endangered habitat types cannot be mitigated and due to the limited remaining extent of these habitat types, any loss of would be of broader significance. Therefore, avoiding impact to the Critically Endangered vegetation types is only viable option in this regard.	
Mitigation » Vegetation clearing should be kept to a minimum and should be restricted to already		

transformed areas.

» Impacts to listed vegetation types should be avoided through careful turbine and access road placement.
» The final placement of turbines and associated infrastructure must follow a micro-siting procedure involving a walk-through and identification of any sensitive areas by botanical, faunal and avifaunal specialists.

Cumulative Impacts

The area is already severely impacted by transformation and additional impacts to intact vegetation would be highly undesirable. Provided that the development can be restricted to transformed habitats, then the construction of the facility would contribute little to cumulative habitat loss and degradation in the area.

Residual Impacts

Provided that the development avoids impact to the listed ecosystems at the site, then residual impacts from the construction phase would be very low.

Impact Nature: Roads, turbine lay-down areas and other transformed areas will reduce landscape connectivity and represent barriers to movement for some species.

	Without Mitigation	With Mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (48)	Low (27)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes, to a certain extent. Noise and disturbance will accompany the construction phase of the development and little can be done to mitigate many of these impacts. This is however transient and disturbance levels will fall considerably after construction.	

Mitigation

» Hardened surfaces should be kept to a minimum
» Roads should be as narrow as possible and as short as possible. A natural surface such as gravel would be preferable to a tarred or concrete road, except in very steep areas where it would be difficult to prevent erosion of natural surfaces.
» Vegetation should be allowed to remain alongside or encroach on the roads as much as possible.
» Temporary lay-down areas should be in previously transformed areas or areas that will be used by the development.

Cumulative Impacts

The area is already severely impacted by transformation and further fragmentation of the landscape would be highly undesirable. This is especially the case in the south eastern section of the site where there are significant remnants of Renosterveld and some landscape

function has still been retained. Therefore cumulative impacts on landscape connectivity would be related primarily to the disruption of this area. Provided that some mitigation is implemented and the intact vegetation is avoided, then the cumulative impacts could be reduced to a low level.

Residual Impacts

Although the high levels of disturbance will be transient and restricted to the construction period, there will also be some residual impacts which are related to the operational phase of the development.

Impact Nature: Fauna will be directly impacted by the development as a result of construction activities and human presence at the site during construction.

	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)
Duration	Short-term (3)	Short-term (3)
Magnitude	Medium (5)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (40)	Low (21)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some extent	

Mitigation

» Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
» No fires should be allowed on the site.
» No fuel wood collection should be allowed on-site.
» No loose dogs should be allowed on site.
» If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» No unauthorized persons should be allowed onto the site.
» All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.

Cumulative Impacts

The construction of the facility will contribute to faunal disturbance in the area, but the impact will be transient and the overall long-term significance is likely to be low.

Residual Impacts

Residual impacts for fauna can be mitigated to a large degree, although some mortality of a few immobile species can be expected.

Impact tables summarising potential impacts on fauna that may arise from the operational phase

Impact Nature: Habitat loss and degradation will have a negative effect on resident fauna. In particular the presence of roads and other open areas and the noise generated by the turbines will constitute habitat degradation for many fauna.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (44)	Low (27)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	The noise produced by the turbines cannot be mitigated and will result in indirect habitat loss or degradation. If recovery of the vegetation within cleared areas is encouraged then some mitigation will be achieved in terms of direct habitat loss.	
Mitigation » Impacts related to the noise and movement of the turbines cannot be avoided. Restricting the turbines to transformed habitats will however partly reduce the impact as faunal activity in the transformed habitats is relatively low. » Where possible, vegetation should be allowed to recover along roads and on turbine service areas. » Regular monitoring of the site for erosion and alien plant infestation, which reduce the value of the affected area for fauna and contribute to a decline in biodiversity.		
Cumulative Impacts The area is already severely impacted by transformation and additional impacts to intact vegetation would be highly undesirable. The operational phase will contribute to some degree to cumulative habitat degradation in the area, but given the relatively limited extent of the development, this impact is not likely to be of broader significance.		
Residual Impacts Provided that the development avoids impact to the listed ecosystems at the site, then residual impacts from the operational phase would be restricted to the impacts related to the noise generated by the turbines as well as any other secondary impacts such as erosion and alien plant invasion which are not controlled.		

Impact Nature: Roads, turbine lay-down areas and other transformed areas will reduce landscape connectivity and represent barriers to movement for some species. The noise generated by the turbines may also deter some fauna from the area.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)

Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes, except for those related to noise.	

Mitigation

» Only sensitive and essential infrastructure should be fenced off and electrified fencing close to the ground should be avoided as this kills tortoises.
» Where possible some vegetation recovery should be tolerated on access roads and turbine service areas.
» Disturbance to fauna during maintenance activities should be kept to a minimum.

Cumulative Impacts

The area is already severely impacted by transformation and further fragmentation of the landscape would be highly undesirable. This is especially the case in the south eastern section of the site where there are significant remnants of Renosterveld and some landscape function has still been retained. Therefore cumulative impacts on landscape connectivity would be related primarily to the disruption of this area. Provided that some mitigation is implemented and the intact vegetation is avoided, then the cumulative impacts would be reduced to a low level.

Residual Impacts

There will be some residual impact related to the presence of the facility such as noise during operation and occasional disturbance during maintenance activities.

Impact Nature: Fauna will be directly impacted by the development as a result of operation and maintenance activities.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (3)	Short-term (3)
Magnitude	Medium (5)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (40)	Low (21)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some extent	

Mitigation

» Access to the site should be restricted and only permitted staff and maintenance crews allowed on-site.
» No access should be allowed to the site at night.
» Any fauna encountered during maintenance activities should be allowed to move off on their own. Tortoises and other slow-moving animals can be carefully moved to a sheltered site out of the way.

» If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All maintenance vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. » No herbicides should be used to control indigenous flora.
Cumulative Impacts The operation of the facility will generate relatively low impacts compared to the construction phase and the operation of the facility would not contribute and significant amount of direct cumulative faunal impacts after mitigation.
Residual Impacts Direct faunal impacts related to the operational phase of the development are likely to be low.

Impact tables summarising potential impacts on fauna that may arise from the decommissioning phase

Impact Nature: Habitat loss and degradation will have a negative effect on resident fauna. In particular clearing activities and lack of follow-up revegetation may result in degradation as a result of alien plant invasion as well as erosion.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (44)	Low (24)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation » Active rehabilitation of any disturbed areas within natural vegetation or areas which perform important ecosystem function such as drainage lines. » Regular monitoring of the site after decommissioning for erosion and alien plant infestation.		
Cumulative Impacts The decommissioning will not contribute to cumulative impact if conducted in a responsible manner.		
Residual Impacts If the infrastructure is removed in a sensitive manner and follow-up revegetation and erosion and alien control are exercised there will be very little residual impact.		

Impact Nature: If roads and other hard infrastructure are not removed during

decommissioning they would contribute to reduced landscape connectivity.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (0)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	Low (30)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation » Follow-up monitoring to ensure that cleared areas have revegetated. » Follow-up monitoring to ensure that alien plant invasion and erosion are minimized.		
Cumulative Impacts Decommissioning would reduce the impact of the facility and would have cumulative net benefit for the area if conducted responsibly.		
Residual Impacts There will be no residual impact if decommissioning is conducted in a responsible manner and follow-up measures are implemented to ensure that revegetation takes place and erosion and alien plant invasion are minimized.		

Impact Nature: Fauna will be directly impacted by the decommissioning as a result of the likely operation of heavy machinery on site as well as construction personnel.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (4)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (32)	Low (18)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation » Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site. » No fires should be allowed on the site. » No fuel wood collection should be allowed on-site. » No loose dogs should be allowed on site. » If the site must be lit at night for security purposes, this should be done with low-UV		

type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » No unauthorized persons should be allowed onto the site. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
Cumulative Impacts Decommissioning will not result in significant long-term cumulative impacts on fauna.
Residual Impacts There will be no residual impacts after mitigation

8.2.1. Comparative Assessment of Power Line and Substation Alternatives

In terms of the assessment of the preferred options regarding the substation and power line alternatives, substation option B, along the southwestern boundary of the site is considered the preferred option. This alternative is adjacent to existing Bredasdorp-Vryheid line and would reduce the likely impact of the overhead line compared to the alternative option. The botanical and faunal sensitivity of this option is also very low and no significant impacts on biodiversity would be likely to be generated by the substation at option B.

8.2.2. Cumulative impacts

The area is already severely impacted by transformation and additional impacts to intact vegetation would be highly undesirable. Provided that the development can be restricted to transformed habitats, then the construction of the facility would contribute little to cumulative habitat loss and degradation in the area.

8.2.3. Conclusions and Recommendations

Although the majority of the Goereesoe site has been transformed for intensive agriculture, the remaining natural areas retain a large amount of biodiversity and should all be considered highly sensitive. Development within the transformed areas would result in very little impact on terrestrial biodiversity and would pose little long-term risk of degradation or other negative impact on the local environment. The presence of Critically Endangered ecosystems within the site is however a key factor and impact to these exceptional ecosystems would result in a high impact significance. Turbines 6 and 7 are singled out in this regard and should be relocated to adjacent less sensitive areas. Provided that the sensitive areas can be avoided, the overall impact of the development on terrestrial fauna would be low.

In terms of the substation options, the preferred alternative (Alternative B) at the centre of the site appears to be the best option, but there is little difference between the sites themselves and the option which results in the shortest overhead power line to the Eskom grid connection point would be the preferred alternative. The majority of impact associated with the development would occur during the construction phase and would result from disturbance and vegetation clearing. During the operational phase the majority of impacts would result from noise generated by the turbines as well as occasional disturbance due to maintenance activities and it is not likely that these impacts would be of wider significance.

8.3 Assessment of Potential Impacts on Avifauna

The proposed Goereesoe Wind Energy Facility site falls within the Fynbos biome which is characterized by a high diversity in plant species composition and endemism (Harrison *et al*., 1997). This biome has two major vegetation divisions:

» proper fynbos characterised by restioid, ericoid and proteoid components;
» renosterveld dominated by Asteraceae, specifically Renosterbos (*Elytropappus rhinocerotis*), with geophytes and some grasses.

Despite its apparent vegetation diversity, the Fynbos biome is regarded as relatively poor in avifaunal diversity compared to other southern African biomes. Nonetheless, this biome includes some endemic species, such as the Cape Rock-jumper (*Chaetops frenatus*), Victorin's Warbler (*Cryptillas victorini*), Cape Sugarbird (*Promerops cafer*), Orange-breasted Sunbird (*Anthobaphes violacea*), Protea Seedeater (*Crithagra leucopterus*) and Cape Siskin (*Crithagra totta*). From these, the Cape Rock-jumper and Victorian's Warbler are listed a priority species on the BLSA list of priority species for wind farms (Retief *et al*., 2012).

Despite the bird species that are naturally associated with the Fynbos biome other species which are associated with other relevant habitats may also occur. These may be affected by factors such as land-use, topography and the presence of drainage lines and wetlands. The proposed Goereesoe Wind Energy Facility is included in the Overberg wheat belt, classified as an Important Bird Area (IBA) which is composed of a mosaic of wheat, barley and canola fields interspersed with pastures (Barnes, 1998). This large agricultural district stretches from Caledon to Riversdale and encompasses the area south of these two towns, running between the coastal towns of Hermanus and Stilbaai. The topography consists mostly of undulating hills and coastal plains, with a fertile soil, ideal for cereal crops. The most common cereal crops are wheat and barley, sown in rotation, together with dry land pastures. A relatively new development, however, is the replacement of grain on some lands with the oil-seed crop, canola. Sheep, cattle and ostriches are grazed on pastures. Dense infestation of woody alien invasive plants (mainly Australian *Acacia* species) occurs in Fynbos areas, but is less prevalent in farmlands

(Young *et al*., 2003). Potential avifaunal micro habitats identified at the site are described below (Figure 8.5):

» **Renosterveld scrub and thicket**

The areas of natural vegetation associated with the Fynbos biome are mostly situated in drainage lines and against steeper slopes and rocky areas that are not usable for crop planting. Priority species that could use these areas of natural habitat at the site include Lanner Falcon (*Falco biarmicus*), Secretarybird (*Sagittarius serpentarius*), Denham's Bustard (*Neotis denhamii*), Black Harrier (*Circus maurus*), Jackal Buzzard (*Buteo rufofuscus*), Steppe Buzzard (*Buteo vulpinus*), Grey-winged Francolin (*Scleroptila africanu*)*s,* Karoo Korhaan (*Eupodotis vigorsii*)*,* Spotted Eagle-Owl (*Bubo africanus*)*,* Martial Eagle (*Polemaetus bellicosus*)*,* Southern Black Korhaan (*Afrotis afra*) and Booted Eagle *(Aquila pennatus*) (Appendix IV of the bird report- refer to Appendix H of this report).

» **Agriculture**

Most of the agricultural practices present on the site are connected with the typical Overberg mixture of cereal crops and pastures. Priority species that could forage in this habitat are Blue Crane (*Anthropoides paradiseus*), Agulhas Long-billed Lark (*Certhilauda brevirostris*), Black Sparrowhawk (*Accipiter melanoleucus*)*,* Denham's Bustard, Black Harrier, Jackal Buzzard, Steppe Buzzard, Grey-winged Francolin, Karoo Korhaan, Martial Eagle, Booted Eagle and Cape Vulture.

» **Wetlands and dams**

The site contains several farm dams, which depending on the design can be important for some bird species. Dams with shallow sloping sides are suitable for a wider range of species. In the context of this study, few shallow dams with sloping sides exist on the site, but the existing ones could potentially be used as roost sites by Blue Cranes and a variety of water birds. Large dams can also potentially be utilised by African Fish-Eagle (*Haliaeetus vocifer*), Lesser Flamingo (*Phoeniconaias minor*), Greater Flamingo (*Phoeniconaias minor*) and Great White Pelican (*Pelecanus onocrotalus*)*.*

» **Exotic trees**

Other micro-habitats within and immediately adjacent to the proposed site, which are important for a number of priority raptor species, are stands of alien trees. Stands of exotic Eucalyptus create attractive habitat for priority species such as Black Sparrowhawk, Spotted Eagle-Owl and Jackal Buzzard.

Figure 8.5: Example of some of the microhabitats with importance to avifauna in the proposed study site: (a) Fynbos biome (b) Agriculture (c) Dams and Wetlands (d) Exotic trees.

According to all the data collected[10] (from vantage points and incidental observations) a total of 17 species of raptors and large terrestrial birds (including 2 species of Crows and 1 Raven) were observed in the study area and its surroundings (Appendix IV of the bird report- refer to Appendix H of this report). According to the South African Red List Conservation Status (Barnes, 2000) 2 species have populations considered endangered: Blue Crane, which is considered Vulnerable, and Black Harrier that is considered Near Threatened (Appendix IV of the bird report- refer to Appendix H of this report). The global populations of Black Harrier and Blue Crane are also considered Vulnerable (IUCN, 2012). Three of the species identified at the study area are Endemic to southern Africa (IUCN, 2012) and near endemic to South Africa region (Barnes *et al.*, 2000): Jackal Buzzard (*Buteo rufofuscus*), Blue Crane (*Anthropoides paradiseus*) and Black Harrier (*Circus maurus*).

From the total contacts registered (175), only 1 contact (1,14%) could not be identified since the identification resulted from a brief observation of a kestrel

[10] All the movements registered (routes) during the field work conducted for the raptors and large terrestrial birds are detailed in Appendix IV of the bird report- refer to Appendix H of this report.

individual (Kestrel sp.). The species with more contacts in the study area was Blue Crane (53 contacts in 13,71% of the grid cells of the study area), with a high percentage of this contact being made at less than 500m from the grid cells located on the proposed wind turbines locations (60,71%). The Black-headed Heron and the Yellow-billed Kite were species also considered frequent in the study area (18 and 10 contacts respectively), with over 25% of these contacts were made in grid cells that were at less than 500m from the wind turbines. In terms of the Black Harrier, a species with unfavourable conservation status, it is important to note that this species was observed in about 17,86% of the grid cells at less than 500m from the proposed wind turbine locations, with a total of 19 contacts.

The spatial analysis of the study area was conducted and revealed that the movements of raptors and large terrestrial birds occurred mostly in the central portion of the Goereesoe Wind Energy Facility area. This area is characterized by an almost flat plain of agricultural pasture, and some fynbos areas, with smaller hills in the south-east of the study area. The higher average number of contacts obtained were due mostly to passage / commuting flights at medium/low altitude of birds (e.g. Blue Crane, Black-Headed Heron) indicating that this may constitute a natural pathway for some birds commuting between feeding and/or roosting areas.

From all the types and heights of flights recorded at the vantage points by the avifauna specialist, a spatial analysis of the area was conducted and the *Collision Hazard Index* for the Goereesoe Wind Energy Facility was estimated. From these preliminary results (refer to Figure 8.6) it was identified that the highest values of the *Collision Hazard Index* were located on the west side of the wind energy facility and relatively close to two turbines (turbine 4 and 13), though none of the wind turbines are located in grid cells with high values of collision risk. These results are due, mostly to the records of Blue Cranes and Yellow-billed Kites using this area.

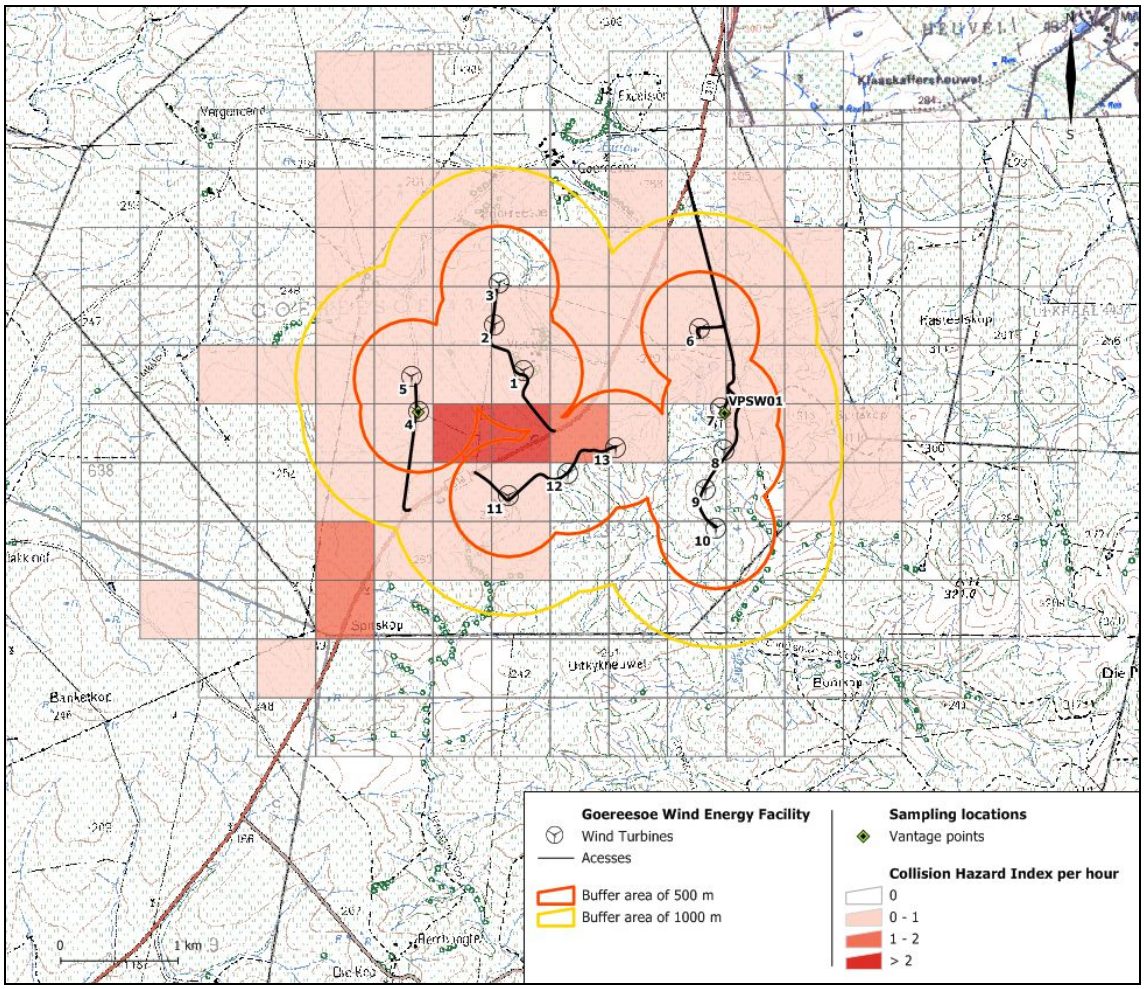

Figure 8.6: Collision Hazard Index, based on the information collected from the vantage points conducted during the survey of November 2012 at the Goereesoe Wind Energy Facility and immediate surroundings

8.3.1. Sensitivity mapping for the proposed site

Sensitive areas for birds are to be highlighted with the purpose of indicating areas where Wind Energy Facility construction and maintenance activities should be kept to a minimum, and when possible and/or technically viable, should be avoided (refer to figure 8.7). Considering the surrounding environment of the proposed site, it is understandable that most of the area is considered as low sensitive areas. Some areas were selected, namely the riparian vegetation and water bodies, due to their importance for some species, as a generous portion of the priority species present in the area are associated or dependent on this type of habitat. Therefore, a 150m buffer around riparian vegetation has been defined as an indication of potentially sensitive areas, which should not be disturbed, if possible.

Apart from the riparian vegetation and water bodies, an area of high activity for raptors and large terrestrial birds (e.g. Blue Crane) was also identified during the field visit undertaken by the avifauna specialist. In this particular area, special

attention should be focussed on mitigation of possible impacts associated with the installation of overhead power lines, since this area is possibly prone to bird collisions. For this reason, the developer should consider implementing a segment of underground power line in this area or, if not possible, the installation of bird flight diverters on the power line section crossing this high activity area (if coincident).

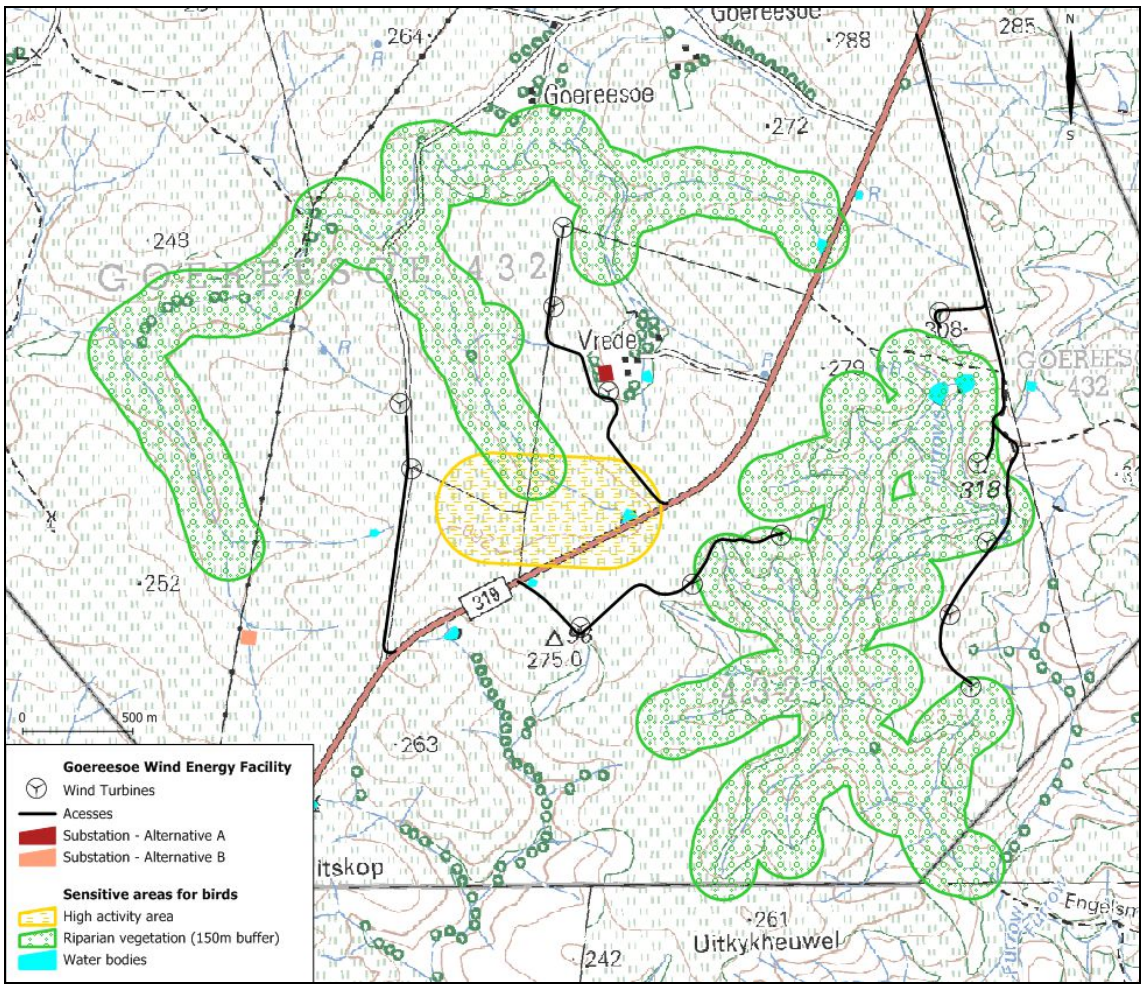

Figure 8.7: Bird sensitive areas in the Goereesoe Wind Energy Facility and its surroundings

8.3.2. Bird Mortalities due to collisions with wind turbines

The crucial issue of concern is mortality of birds through collision with the turbine rotor blades and the degree to which such mortality is acceptable for particular groups or species of birds. The risk of collision mortality varies in several general ways and these affect the manner in which collision mortality can be mitigated. Birds flying in daylight have a better chance of seeing and avoiding turbines than those flying at night –hence the major concern raised over the night moving transients. Daylight fliers may have an increased risk in periods of fog or mist when visibility is severely reduced. The other factors that affect bird collision with turbines are:

» The degree to which birds fly at heights equivalent to the turbine rotor blades – planned to be 40-140 m above ground level;
» Their ability to manoeuvre in flight – which is lower for larger and heavier bird species;
» The degree to which birds may be pre-occupied - i.e. through chasing prey or in courtship display – and so pay less attention to moving rotor blades;
» Familiarity with the location of turbines;
» The frequency with which they place themselves at risk of collision; and
» The angle of approach since rotor blades are more conspicuous seen head on than from the side.

Impact tables summarising potential impacts on avifauna that may arise from the construction phase

Nature: Destruction of agricultural land and grasslands due to the construction of platforms; workstation and substation; internal access roads; turbines, and the installation of underground cabling and overhead power lines

The main impacts resulting from the construction phase will be habitat destruction from opening clearings for the working areas and disturbance of birds due to the increase of people and vehicles in the area, high levels of noise and machinery movements.

The study area is mainly occupied by agricultural land, mostly cereal fields, pasture and grassland, with some areas of renosterveld scrub and thicket, with many water bodies, mostly farm dams, spread throughout the proposed site. It is expected that the affected biotopes will be mostly agricultural land and grassland and birds should already have some degree of tolerance to human presence and activities (e.g. associated with agriculture activities). The agricultural lands and the grasslands are biotopes with low value, though priority species can use these as resources (e.g. bustards and raptors). However these habitats are easily recovered to their pre-construction condition, once the construction activities ceases. The destruction of these

habitats mainly due to the installation of the wind energy facility and associated infrastructure are considered impacts of medium significance, mainly because the occupied area will be permanently affected and the impact cannot be diverted nor can be prevented from happening.

	Without mitigation	With mitigation
Extent	2 (Local)	1 (Local)
Duration	5 (Permanent)	5 (Permanent)
Magnitude	4 (Low)	2 (Minor)
Probability	5 (Definite)	4 (Highly Probable)
Significance	**55 (Medium)**	**32 (Medium)**
Status	Negative	Negative
Reversibility	Low	Reversible
Irreplaceable loss of resources	Possible	No
Can impacts be mitigated	Yes	-

Mitigation:

» The minimization of this impact is mainly achieved through the avoidance of setting of infrastructure, especially turbines, in the sensitive areas, in a layout planning phase, or through minimisation of the affected area as far as possible as a result of the activities of clearance and removal of vegetation.
» Existing roads and infra-structures should be used in order to minimize landscape changes.
» If large portions of sensitive areas are affected, measures should be taken to restore vegetation as soon as possible after construction is completed.

Cumulative impacts:

» Potential cumulative impacts with another wind energy facility planned to the north of Goereesoe development.
» Significance of cumulative impacts will depend on the timing of the construction, with the significance of these cumulative impacts being higher if the construction of both developments occurs simultaneously and lower if development is not simultaneous, and lowest if these events occur after the regeneration / rehabilitation of the affected vegetation of the first facility constructed.
» The cumulative impacts associated with the construction phase are considered to be of very low significance.

Residual impacts:

» Once the construction ceases and if the mitigation measures are implemented no residual impacts are expected.

Nature: Disturbance of bird community and impact on Red Listed species due to the increase of people and vehicles in the area

The disturbance due to people and vehicle presence and driving is considered an impact of low significance, especially because the impact is temporary and with a very restricted area of impact, having therefore a local to medium extent. However some resident/breeding/visiting raptors (e.g. Verreaux's Eagle, Secretarybird, Martial Eagle, Black Harrier) can be easily disturbed by the construction activities of the wind energy facility and their breeding/feeding activities may be affected, resulting in them

temporarily abandoning the site.		
	Without mitigation	With mitigation
Extent	3 (Medium)	1 (Local)
Duration	1 (Very Short)	1 (Very Short)
Magnitude	4 (Low)	2 (Minor)
Probability	3 (Probable)	3 (Probable)
Significance	**24 (Low)**	**12 (Low)**
Status	Negative	Negative
Reversibility	Medium	Reversible
Irreplaceable loss of resources	Possible	No
Can impacts be mitigated	Yes	-

Mitigation:

» In order to minimize this impact certain measures can be taken, such as avoid the presence of people and vehicles in the sensitive areas; whenever possible schedule activities in order not to cause disturbance during the breeding season; lower the levels of noise whenever possible around the sensitive areas.

Cumulative impacts:

» Cumulative Impacts associated with the potential disturbance derived from the construction phase of the project are not expected since the construction phase of other wind energy facilities, or other types of projects, is not expected to occur simultaneously in the immediate surroundings of the study area.

Residual impacts:

» Not likely to persist, once the construction ceases. However some species may move away regardless of any mitigation measures implemented.

Impact tables summarising potential impacts on avifauna that may arise from the operation phase

Nature: Mortality of species, including priority species, due to turbines operation and collision with the rotating blades; collision and electrocution with overhead power lines

It is during operational phase that the most significant potential impacts on bird communities can occur. These impacts are mostly related with bird mortality due to collision with turbine blades or with overhead power lines. The collision risk is not the same for all species and it varies according to the species' habits and ecology. Certain bird habits, such as migration, high flight or nocturnal flight, hunting or foraging in mid-air, contribute to species susceptibility to collision (Retief et al., 2012). From the 290 bird species with possible and confirmed occurrence in the study area, 18 have high risk of collision with turbines, and 43 have a moderate probability of being affected by mortality due to collision with these infrastructures. From these, 20 are species with endangered conservation status (Barnes, 2000) and include 16 priority species (Retief et al. 2012) (Appendix IV of the bird report- refer to Appendix H of this report).

Considering the analysis of raptors and large terrestrial birds' movements within the Wind Energy Facility site as investigated in the avifauna specialist report, the minimisation of disturbance and construction activities in the areas with highest

registered activity is recommended, and the placement of underground cabling in the areas identified with high collision risk (instead of constructing an overhead power line) is recommended (Figure 8.6) (central area of the wind energy facility, between wind turbines 4 and 5 at west, 11, 12 and 13 at the south, 1, 2 and 3 at the north, and 7 and 8 at the east).

Bird mortality due to collision with infrastructures is considered an impact of medium significance, mostly due to the high probability of occurrence and its permanent character.

	Without mitigation	With mitigation
Extent	3 (Medium)	2 (Local – Medium)
Duration	5 (Permanent)	5 (Permanent)
Magnitude	6 (Moderate)	6 (Moderate)
Probability	4 (Highly Probable)	2 (Improbable)
Significance	**56 (Medium)**	**26 (Low)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	-

Mitigation:

» The minimisation of deaths caused by wind turbines can be achieved through the avoidance of turbines placement in sensitive areas for birds.
» From the proposed layout, none of the turbines are placed within the assessed high collision risk areas, or within areas of high activity of priority species. However it is recommended that the overhead power lines should be run underground within the identified sensitive areas (between wind turbines 4 and 5 at west, 11, 12 and 13 at south, 1, 2 and 3 at north, and 7 and 8 at east).
» "On site" power lines should be underground whenever possible. If not possible, high risk sections of line should be identified once the final design of the line is available and bird flight diverters should be installed in these sections to prevent collisions.
» A bird monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bird community.

Cumulative impacts:

» Other wind energy facilities by BioTherm and Innowind are known to be planned to the north of Goereesoe development. In the event of the three wind energy facilities becoming operational, cumulative Impacts may be expected and higher mortality of bird species may occur.
» Due to the small size of Goereesoe wind energy facility (13 turbines) the potential cumulative impacts resulting from the interaction of all developments is considered to be of low significance.
» A bird monitoring program should be implemented and will allow determination of the actual cumulative impacts of the wind energy facility on the bird community.

Residual impacts:

» Some collisions are expected despite the implementation of mitigation. This will result in bird mortality which will result in residual impacts. A bird monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bird community.

Nature: Disturbance of bird community due to noise and movement generated by turbines operation and increase of people and vehicles in the area associated with maintenance activities.

Considering the disturbance of bird community resulting from the existence of human activities (mainly related with the wind energy facility) and turbines operation in the study area, it is considered an impact of medium to low significance before and after mitigation respectively. This is mostly due to the high probability of occurrence of this impact and the impact it can have on population dynamics through the alteration of activity patterns and possible presence of attraction and/or exclusion areas in the wind energy facility.

	Without mitigation	With mitigation
Extent	3 (Medium)	2 (Local – Medium)
Duration	5 (Permanent)	5 (Permanent)
Magnitude	4 (Minor)	2 (Low)
Probability	3 (Probable)	2 (Improbable)
Significance	**36 (Medium/Low)**	**18 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Possible	Possible
Can impacts be mitigated	Yes	-

Mitigation:

» The minimization of bird community disturbance can be achieved through the avoidance of presence of people and vehicles in the sensitive areas and scheduling of maintenance activities in relation to avian breeding patterns.

» A bird monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bird community.

Cumulative impacts:

» Other wind energy facilities by BioTherm and Innowind are known to be planned to the north of Goereesoe development. In the event of the three wind energy facilities becoming operational, cumulative Impacts may be expected and higher mortality of bird species may occur.

» Due to the small size of Goereesoe wind energy facility (13 turbines) the potential cumulative impacts resulting from the interaction of all developments is considered to be of low significance.

» A bird monitoring program should be implemented and will allow determination of the actual cumulative impacts of the wind energy facility on the bird community.

Residual impacts:

» Some species may move away from the area regardless of any mitigation measures implemented. Some priority species may have their breeding success compromised. A bird monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bird community.

8.3.3.Cumulative impacts

It is already known that the BioTherm Swellendam wind energy facility is being planned in the vicinity of the proposed Goereesoe development. It is planned to be 143MW and is located on the farms Uitkyk RE/434; Excelsior 432 portion 6; Vryheid 435 portion 0; and Klaas Kaffer Heuwel 438 portion 1 to the north of the proposed Goereesoe wind energy facility site. These projects are authorised by the DEA but are not yet a preferred bidder by the Department of Energy. Potential cumulative impacts[11] may derive if the wind energy facility to the north is implemented but its significance will depend on the timing of the construction, with the significance of these cumulative impacts being higher if the construction of both developments occurs simultaneously and lower if development is not simultaneous, and lowest if these events occur after the regeneration / rehabilitation of the affected vegetation of the first facility constructed. The cumulative impacts associated with the construction phase are considered to be of very low significance. It is considered unlikely that the construction of all developments will occur simultaneously, and considering that the impacts during the construction phase are mainly related to habitat destruction and the expected limited extent of the affected areas, the cumulative impacts associated with the construction phase are considered to be of very low significance.

8.3.3. Comparative Assessment of Substation and Power Line Alternatives

Both proposed alternatives for the location of the substation are acceptable and do not impact on any of the indicated sensitive areas (refer to figure 8.7). However, due to its proximity to the connection to the electrical grid, alternative B is preferred as it will minimize the length of the overhead power line to be constructed.

8.3.4. Conclusions and Recommendations

Overall, the impacts during the construction phase are mainly related to habitat destruction. However, due to the limited extent of the affected areas these can be expected to be of medium/low significance, provided the recommended mitigation measures are implemented.

The overall impacts during the operational phase are mainly related to bird mortality and are considered to be of medium significance. With the

[11] Cumulative Impacts derived from one particular project can be defined as “the impacts resulting from incremental actions or activities of the project in study with impacts resulting from other activities or projects from the past, present or reasonably predicted” (Hyder, 1999).

implementation of adequate mitigation these impacts are considered to be of low significance.

The proposed site for the Goereesoe Wind Energy Facility is not located in a very high sensitivity area for bird communities. However, considering the movements and the species observed using the studied area (refer to Figure 8.7), some particular areas could pose a high risk of collision for birds, which should be acknowledged and safeguarded. Since this is a medium-sized installation, the assumed impacts have a medium level of significance.

The identified species most likely to suffer the impacts caused by the presence of this infrastructure mostly include raptors and cranes (e.g. Yellow-billed Kite and Blue Crane), which displayed some flight behaviour that suggest a higher possibility of collision mortality with wind turbines. Pre-, during- and post- construction monitoring will be very important to improve the understanding of the real impact caused by the wind energy facility on local bird populations.

The delineation of the sensitive areas should be interpreted as indicative, since they should be confirmed during the pre-construction bird monitoring program which is currently underway on the site. In this indicative layout of the sensitive areas, only three turbines are located within the medium sensitivity zone, i.e. the riparian vegetation area. These turbines are however on the edges of the high sensitivity area which may require some restriction for construction to be imposed. Planned access roads also intercept the riparian vegetation buffer in some peripheral areas. Realignment of these roads should be considered in order to minimize the disturbance of this sensitive area. Both proposed alternatives for the location of the substation are acceptable and do not impact on any of the indicated sensitive areas (refer to figure 8.7). However, due to its proximity to the connection to the electrical grid, alternative B is preferred as it will minimize the length of the overhead power line to be constructed.

Taking the above statements into consideration, no layout alterations are considered necessary for the Goereesoe wind energy facility, since no highly sensitive areas where identified, such as nests or highly important habitats for the bird community in the study area.

8.4 Assessment of Impacts on Bats

8.4.1. Potential explanations for bat mortalities at wind energy facilities

The primary hypotheses proposed for bat mortalities associated with wind energy facilities are as follows:

» **Direct collision** – a percentage of the dead bats found show signs of physical injury resulting from actual collision from the blades of wind turbines (Handwerk 2008).
» **Changes in flight patterns/Barrier effect for commuting or migrating bats** – caused by the use of topographical features to migrate, for mating behaviour and because of possibly 'turning-off' their echolocation systems (Cryan undated). Wind turbines may also form barriers to their annual migration and/or daily commutes (Cryan 2011).
» **Barotrauma** – the sudden drop in air pressure at wind farms causes a bat's lungs to rapidly expand resulting in the death of the bat (Handwerk 2008).
» **Loss of foraging habitat** – due to either wind energy facility construction or bats avoiding facilities altogether.
» **Emission of ultrasound by turbines** - probably limited.

The potential impacts a development such as the Proposed Goereesoe Wind Farm near Swellendam can have on bats therefore are mainly limited to disturbance and, depending on the importance of the specific habitat to bats, habitat destruction. The large scale destruction of an important roost would have a significant impact on bats. Disturbance of bats during construction and maintenance activities could also have a detrimental effect.

The potential for impacts on bats in the study area by the proposed Goereesoe Wind Energy Facility project is evaluated in terms of impacts related to the main behavioural activities of bats, i.e.:

» Roosting impacts
» Foraging impacts
» Migration impact

Impact tables summarising potential impacts on bats that may arise from the construction and operation phase

Nature: Roost disturbance and/or destruction due to construction activities		
	Without mitigation	**With mitigation**
Extent	2 (Local)	1 (Local)
Duration	5 (permanent)	5 permanent
Magnitude	2 (minor)	2 (minor)
Probability	3 (probable)	2 (improbable)
Significance	**21 (Low)**	**16 (Low)**
Status	Negative	Neutral
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated	Yes	Yes

Mitigation:

» No turbines have been proposed at locations very close to sites identified as potential roost sites, mainly along rocky ridges and outcrops. The correct placement of individual turbines can significantly reduce the impacts on bat roosts in the area.
» Since no turbines have been planned near bat roosts identified on the site, the impact of the construction of the wind energy facility on roosts is expected to be low.
» However, if any bat roosts are discovered, a suitably qualified specialist must be contacted for assistance in dealing with this.
» Construction activity will involve site clearance, hence the removal and clearance of vegetation and possibly some out-buildings for the construction of each turbine and associated infrastructure.
» Despite the expected impact being low the area to be disturbed by pre-construction and construction activities at the turbine localities should still be kept to a minimum.

Cumulative impacts:

» Compounding – the impact of two developments of a similar nature is likely to be more than twice the impact of two single developments. To reduce the possibility of impacting any bat roosts in the area it would be better to place a second development in a different area.

Residual impacts:

» Low – the overall impact of the development on bat roosts in the area is likely to be low.

Nature: Bat fatalities due to collision or barotrauma while foraging

Bat mortalities at wind farms due to collision with turbine blades and barotrauma have been identified globally as a serious threat to bat populations. The potential consequences of high death rates at the study site include economic losses (since insectivorous bats provide essential pest control services to farmers), social breakdown amongst gregarious colonies (Kerth *et al.* 2011) and loss of Conservation Important Species (i.e. the Near Threatened *M. natalensis* which is expected to occur on the site).

	Without mitigation	**With mitigation**
Extent	4 (Regional)	3 (Regional)
Duration	5 (permanent)	5 (permanent)
Magnitude	4 (low)	4 (low)
Probability	5 (definite)	5 (definite)
Significance	**65 (High)**	**60 (High)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Possible loss of breeding success and population crash	Possible loss of breeding success and population crash
Can impacts be mitigated	Partially	Partially

Mitigation:

» Bat deaths caused by wind turbines are well documented. Placing turbines in areas of high bat activity and between foraging or drinking areas that may be used as flight paths should be avoided.

» The correct placement of individual turbines can significantly reduce the impacts on bats in the area. The proposed turbine placements for the alternative turbine layout must be critically revised with the key objectives of moving the Turbines located in areas of High Bat Sensitivity (i.e. 1, 3 and 8) to an alternative location. Turbines located in the areas of Moderate Bat Sensitivity (11, 12, and 13) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritized in post-construction monitoring and implementation of mitigation measures (in reference to alternative layout 2- figure 8.8).. » Gaps of at least 250m should be left between turbines. » In addition, informed curtailment programmes should be adopted where necessary. This is when a turbine is kept stationary at a very low wind speed and then allowed to rotate once the wind exceeds a specific speed. » Bats are less likely to be active during nights of higher wind speeds. Since this study showed that bats occur across the entire study area assessed it is likely that the proposed development will have a high impact on bat populations though collisions and barotrauma even with appropriate mitigation measures. » Long-term pre- and post-construction monitoring should be implemented to better inform such conclusions and mitigation decisions.
Cumulative impacts: » Compounding – the impact of two developments of a similar nature is likely to be more than twice the impact of two single developments. To reduce the possibility of impacting any bat roosts in the area it would be better to place a second development in a different area.
Residual impacts: » High – permanent impact of turbines for life of Wind Energy Facility.

Nature: Disturbance to and displacement from foraging habitat due to wind turbine construction and operation

The impact of lighting on bat behaviour can have two different results. It can either attract bats that prey on insects or it can disturb bats and act as a barrier to movement (Outen 1998). Therefore as mentioned above it is advisable to keep lighting to a minimum to avoid attracting certain species and to avoid disturbing others. It is not envisaged that this will have a very large impact but it is something to be aware of once operation begins. Should it become a large problem a suitably qualified bat specialist should be contacted to resolve the issue.

It must also be noted that the construction of certain structures may attract bats. Many houses are used all over the world as roost sites. This can cause distress to people as these bats may soil walls and floors with their faeces

It is therefore suggested that during construction newly constructed buildings be sealed as much as possible from bats. This will help to mitigate for this impact. This is more of a business impact as bats are unlikely to be negatively affected by this unless they are physically killed by the people on site.

	Without mitigation	**With mitigation**

Extent	2 (Local)	2 (Local)
Duration	5 (permanent)	4 (permanent)
Magnitude	5 (low)	3 (minor)
Probability	4 (highly probable)	4 (highly probable)
Significance	**48 (Medium)**	**36 (Medium)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	Possible loss of breeding success	Possible loss of breeding success
Can impacts be mitigated	Yes	Yes

Mitigation:

» A standard construction EMP must be compiled and implemented by thecontractor.
» The disturbance should decrease after construction is complete; however the use of lights can have a more permanent disturbance or attractive impact on bats.
» It is advisable that the lighting needs of the project are carefully considered and minimal lighting be used if possible.
» Low pressure sodium lamps are recommended, or UV filters should be fitted to other types of light.
» This will decrease the attraction of insects and thus to bat species.
» There should be no large scale lines of lights as these can act as barriers to bat movement.
» In addition curtailment programmes should be adopted to reduce displacement from foraging habitat during times when bats are more likely to be active.

Cumulative impacts:

» Compounding – the impact of two developments of a similar nature is likely to be more than twice the impact of two single developments. To reduce the possibility of displacing bats from foraging areas in the area it would be better to place a second development in a different area.

Residual impacts:

» Medium – temporary impact from construction but large impact from lighting.

Nature: Bat fatalities due to collision or barotrauma during migration

Additional and on-going research on the migratory behaviour of southern African bats is vital if we are to better understand the impacts that wind energy facilities will have on their migrations. In additional to monitoring bat activity in relations to wind speed, temperature and humidity data and to maximize the reduction of bat fatalities, wind energy facility operation plans should incorporate the response of migratory bat species to environmental variables, such as barometric pressure and fraction of moon phase, into their existing mitigation strategies.

	Without mitigation	**With mitigation**
Extent	5 (Regional)	4 (Regional)
Duration	5 (permanent)	5 (permanent)
Magnitude	5 (low)	4 (low)
Probability	5 (definite)	5 (definite)

Significance	**75 (High)**	**65 (Medium)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	Possible loss of breeding success and population crash	Possible loss of breeding success and population crash
Can impacts be mitigated	Partially	Partially

Mitigation:

» It has been shown that migrating bats are at higher risk of mortality through collision with turbine blades or barotrauma than non-migrating species. Little is understood about bat migration in South Africa but it is likely that bats migrate on nights of low wind speeds, temperate temperatures and no rain. Therefore, placing turbines in areas of high bat activity and between foraging or drinking areas that may be used as flight paths should be avoided.

» Gaps of at least 250m should be left between turbines.

» In addition, informed curtailment programmes should be adopted if required.

» Long-term pre- and post-construction monitoring should be implemented to better inform such decisions.

Cumulative impacts:

» Compounding - The impact of constructing a second development in the same environment will result in higher bat mortality due to collision and/or barotrauma during migration.

Residual impacts:

» High – permanent impacts of turbines for life of Wind Energy Facility

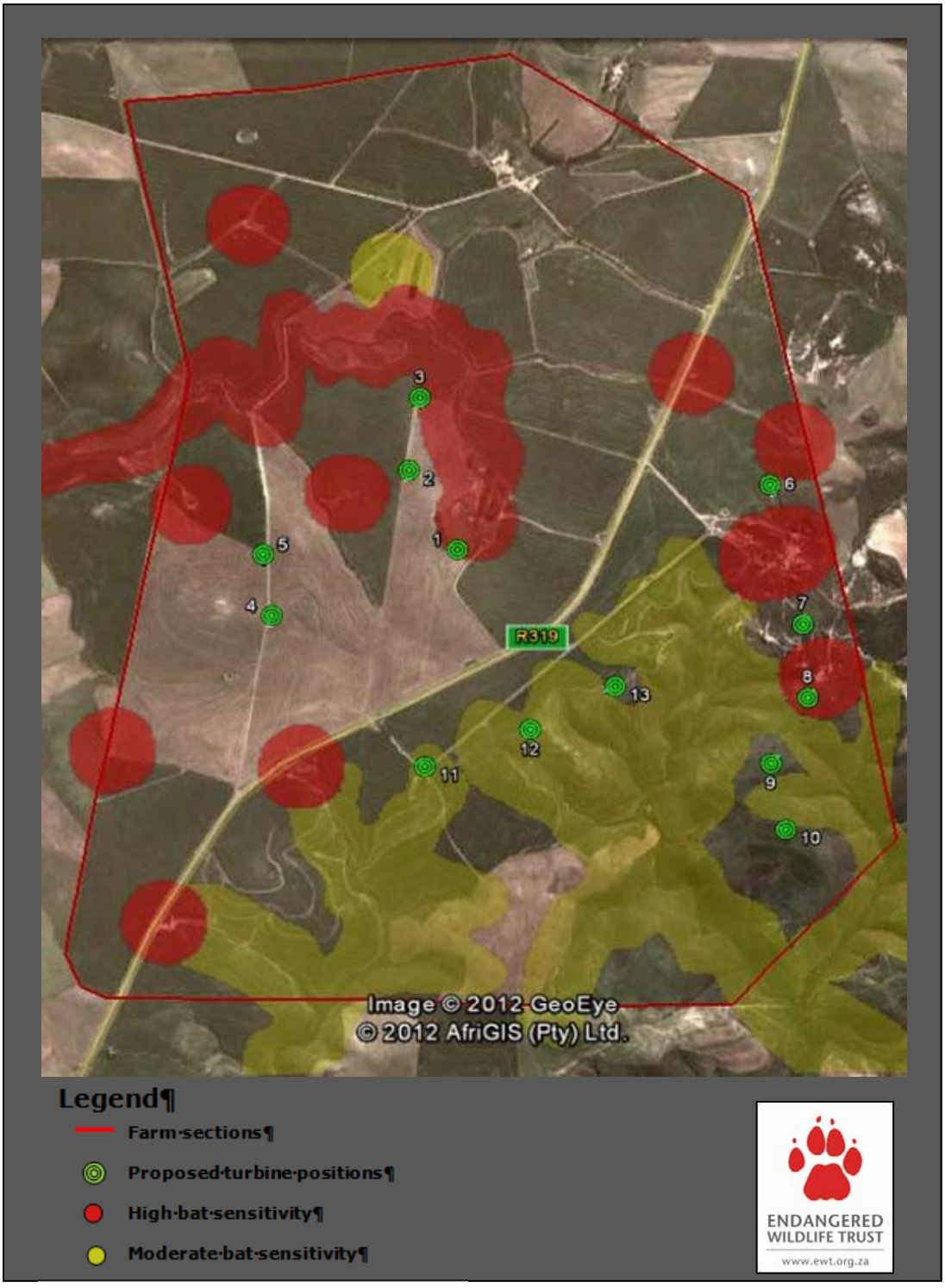

Figure 8.8: Bat sensitive habitats within the study area indicating the proposed layout

8.4.2. Comparative Assessment of Substation and Power Line Alternatives

There is no evidence to suggest that bats which are common to the area are affected by power lines in any way. For this reason the alternative power line routes or substations were not assessed as part of this study.

8.4.3. Cumulative impacts

the impact of two developments of a similar nature is likely to be more than twice the impact of two single developments. . Should the Uitkyk/Excelsior wind energy facility on the adjacent property be developed, this could cumulatively result in higher rates of bat mortality due to collision or barotrauma. To reduce the possibility of displacing bats from foraging areas in the area it would be better to place a second development in a different area.

8.4.4. Conclusions and Recommendations

Any species that occurs in the area of the proposed wind energy facility is vulnerable to the potentially fatal impacts of wind turbines. At least one of the species identified as potentially occurring in the area of the study site is listed as Vulnerable (*Cleotis percivali)* and three as Near Threatened (*Eidolon helvum, Miniopterus natalensis* and *Rhinolophus swinnyi*). A number of areas throughout the study site were identified as potential roost sites and acoustic recording confirmed that at least one of the bats occurring in the areas is listed as Near Threatened (*Miniopterus natalensis*). The overall impact of the development is likely to be moderate to high if steps to mitigate impacts are not taken. Further studies and monitoring are needed to properly assess the likely impacts and best ways to mitigate them.

The proposed mitigation measures and recommendations described in Section 6 of bat specialist report should be implemented and their practicality and effectiveness researched with high priority at all turbines on this site. The proposed turbine placements must be critically revised with the key objectives of moving the Turbine located in area of High Bat Sensitivity (i.e. turbines 1, 3 and 8) to an alternative location. Turbines located in the areas of Moderate Bat Sensitivity (i.e. turbines 11, 12 and 13) should preferably be moved to alternative locations. If this is not possible due to other constraints, these turbines must at least be prioritized in post-construction monitoring and implementation of mitigation measures.

Gaps of at least 250m should be left between turbines. In addition, informed curtailment programmes should be adopted where required. Post construction monitoring of bat fatalities during the operational phase is recommended for at least four seasons at the proposed wind energy facility. Every effort should be

made to mitigate the impacts on bats during this project through implementation of a construction EMP as well as by following the recommendations in this report.

With regards to this development, the following points must be stressed:

» A pre-construction monitoring program is seen as critical in extending our knowledge of wind energy and bat interactions. It is recommended that a monitoring program be planned to collect data on a host of environmental factors. This should be initiated as soon as possible to ensure robustness of data.[12]
» All future wind energy projects and plans for pre- and post-construction monitoring should consider the Sowler & Stoffberg (2012) guidelines, in conjunction with an experienced specialist, in order to understand:
  * Seasonal and diurnal bat activity rhythms at the site.
  * The abundance of bat activity and which species are utilizing the site.
  * Site specific risks/ impacts to bats associated with the proposed WEF.
  * Effective mitigation and monitoring methods that will be appropriate for the wind energy facility.
» It is recommended that static monitors be placed on the meteorological mast as soon as possible so that pre-construction monitoring data can be gathered to better inform the construction and operational phases.

8.5 Assessment of Potential Impacts on Soil, Land Use, Land Capability and Agricultural Potential

A land use map (Figure 8.9) has been compiled from aerial imagery (NGI & GoogleEarth) and limited personal ground observations, to determine the extent of the cultivated areas. Table 8.2, provides a summary of the results.

Table 8.2: Areas per land use category.

Land use category	Area (ha)
Cultivated fields	1182
Natural veld & Drainage areas	223
Farmsteads and un-cultivated land	42
Roads and road reserves	26
Plantations	7
Dams or Ponds	5
Total	1485

With a total cultivated area of 1182 ha, approximately 700 ha will annually be sown to wheat, barley or canola.

[12] Note that pre-construction monitoring of bat communities on the site commenced in January 2013

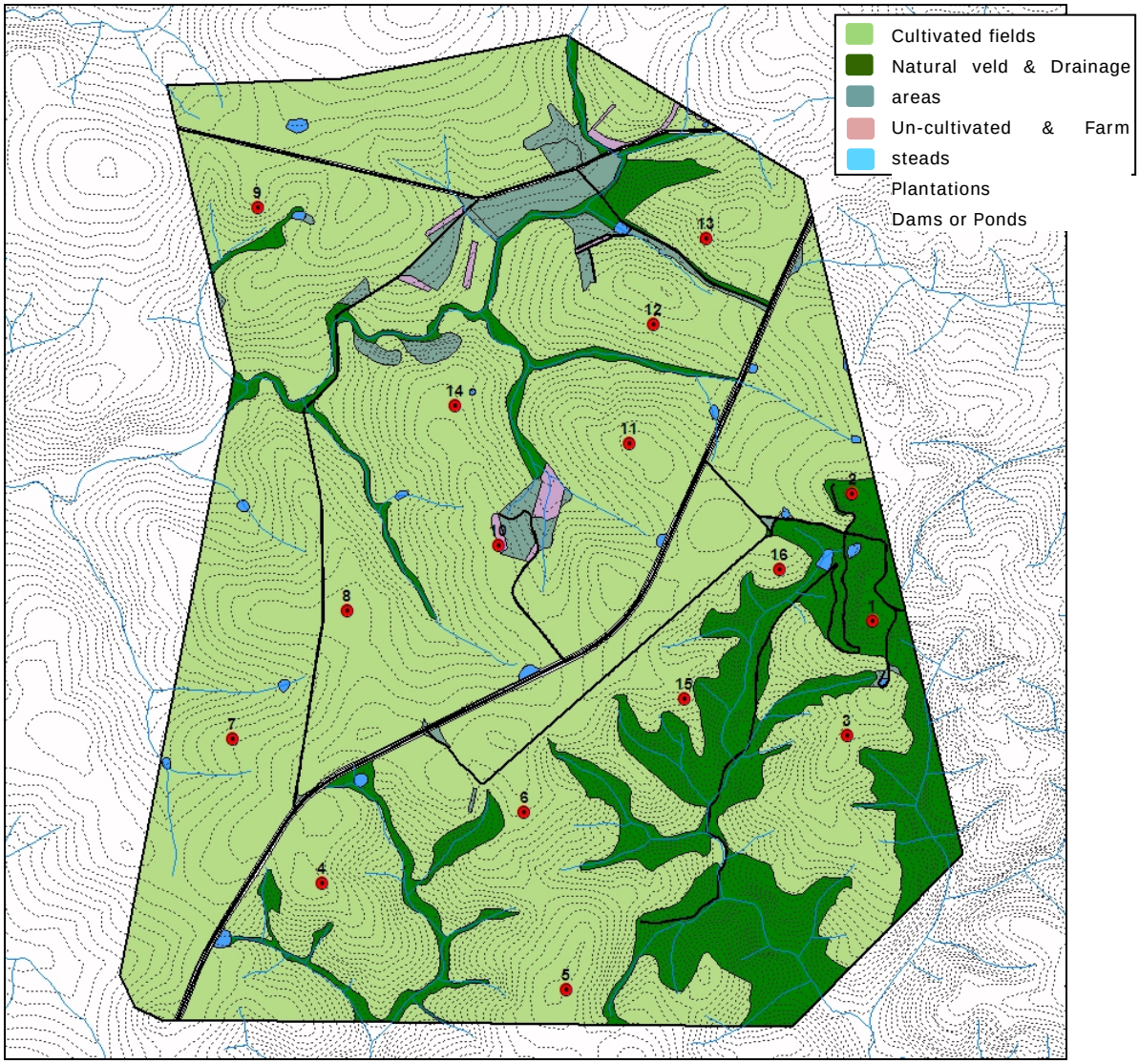

Figure 8.9: Agricultural land use at Goreesoe. (indicative of alternate layout 1)

The photographs on the following pages provide a visual overview of the activities and character of the land.

Figure 8.10: Typical agricultural scenery in the study area

Figure 8.11: Well established and stable contour banks and natural drainage lines.

The proposed Goreesoe wind energy facility will occupy a combined area of not more than 4.5 ha out of 1182 ha (0.38%) of medium potential dryland cultivated fields. Provided that all mitigation measures are carefully applied, the impact on agricultural activities and the natural resources will be low and normal agricultural use should be possible for the duration of the operation and after decommissioning.

The main impact will be during construction when grazing on certain fields will have to be scheduled to accommodate the construction process. With good planning and co-ordination, most cultivation should also be possible, even during construction.

Nature: Loss of agricultural potential and land capability through the following mechanisms:

1. Loss of agricultural land on development footprint for duration of project
2. Degradation of natural drainage
3. Deterioration of vegetation and veld
4. Soil erosion
5. Disruption of contour banks
6. Disturbance of cultivation practices due to division of existing camps
7. Prevention of crop spraying by aircraft

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (16)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No.	
Can impacts be mitigated	Yes	

Mitigation:

» Micro-site turbines and access roads to prevent disturbance to existing contour banks and to prevent unnecessary sub-division of fields.
» Minimize footprint of disturbance during construction.
» Strip and stockpile all topsoil from disturbed areas for replacement during rehabilitation.
» Implement effective run-off control measures and stormwater management at all times
» Sow oats as cover crop on all construction areas left bare by disturbance to stabilise soils.

Cumulative impacts:

Cumulative impacts can be considered possible due to the likelihood of other projects (renewable energy or other) in the area that will also lead to loss of agricultural land. This cumulative impact is however considered to be of low significance. The footprints of such projects are small in relation to available land. Non-irrigated land is not a particularly limited resource in the area, and relatively small losses of no-irrigation land to agricultural will have very little impact on the total agriculture of the area.

Residual impacts:

Residual impact is considered low because the land will be able to be returned to agriculture after closure with very little change in agricultural potential.

8.5.1. Comparative Assessment of Power Line Alternatives

Both substation sites are in similar areas and so would result in similar impacts.

8.5.2. Cumulative impacts

Cumulative impacts can be considered possible due to the likelihood of other projects (renewable energy or other) in the area that will also lead to loss of agricultural land. This cumulative impact is however considered to be of low significance. The footprints of such projects are small in relation to available land. Non-irrigated land is not a particularly limited resource in the area, and relatively small losses of no-irrigation land to agricultural will have very little impact on the total agriculture of the area.

8.5.3. Conclusions and Recommendations

In order to ensure that the mitigation measures and good agricultural practice guidelines are followed and appropriately applied, it is strongly recommended that an agricultural specialist in natural resources be part of the installation team and periodically visit the site to recommend specific measures as may be required during the construction phase. No specific monitoring guidelines are required during the operational phase, other than monitoring adherence to the DAFF guidelines. The Department of Agriculture reserves the right to visit the renewable energy site at any time without prior arrangement to review the status of the natural resource base and the impact of the renewable energy structures.

DAFF prescribed mitigation measures

The following mitigation measures, applicable to the Goreesoe wind energy facility, are prescribed by the DAFF regulations for renewable energy facilities on agricultural land:

» Every care should be taken before, during and after the construction and future maintenance of the renewable energy structure, supporting infrastructure or access routes to protect the vegetation and veld condition against deterioration and destruction.
» It is the responsibility of the owner of the renewable energy project to ensure that suitable soil conservation works be established on the site to limit or restrict the loss of soil.
» No renewable energy structure, supporting infrastructure or access routes shall in any manner divert any run-off water from a water course to any other water course or obstruct the natural flow pattern of runoff water, except with the permission from DAFF.

» All access routes, existing or newly constructed and utilized during the construction and / or maintenance of the renewable energy structures should be restore to its original state after completion of the establishment of the structures. Ever care should be taken not to damage or degrade the status of the natural resources base of the farm during the construction phase of the mentioned or to impact negatively on the farming or production practices on the farm.
» All service routes that will be used to gain access to the renewable energy structures for maintenance purposes have to be covered in gravel, tarred or compressed in order to limit the possibility of degradation and erosion.
» The installation of the underground power cables should not negatively impact on the resource base of the site. During the installation no soil conservation structure should be disturbed, the soil texture should be restored, the work area should not be wider than 5 m, should not be directed through existing or future cultivated land nor impact negatively on existing farming infrastructure or any farming activity.
» The lease agreement should be transferred to the new land owner, should the farmer decide to sell the property during the time period of the current lease agreement. DAFF needs to be informed of the transfer of the lease agreement upon which a new approval number will be issued. Supporting documentation should be provided that the new land owner concurs with the specifications of the existing lease agreement.

8.6 Assessment of Potential Visual Impacts

8.6.1 Visual Exposure

The result of the preliminary viewshed analyses for the proposed facility is shown on the map overleaf (**Figure 8.12**). The visibility analysis was undertaken from 13 wind turbine positions at an offset of 110m above average ground level (i.e. the maximum hub height of the proposed turbines) in order to simulate a worst case scenario.

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. 10-13 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-3 turbines or parts thereof may be visible).

Potential visual exposure as a result of the proposed wind farm extends primarily to the north-east and south-west of the study area, incorporating a number of farmsteads and other structures as well as the slopes of the undulating landscape. Stretches of the R319 and various secondary roads also fall within this viewshed.

The extent of potential visual exposure is contained by the undulating topography and river valleys in the north-west and the south-east reduce the potential visual exposure in these sections. The viewshed is interrupted by this topography, with mostly farmsteads potentially affected.

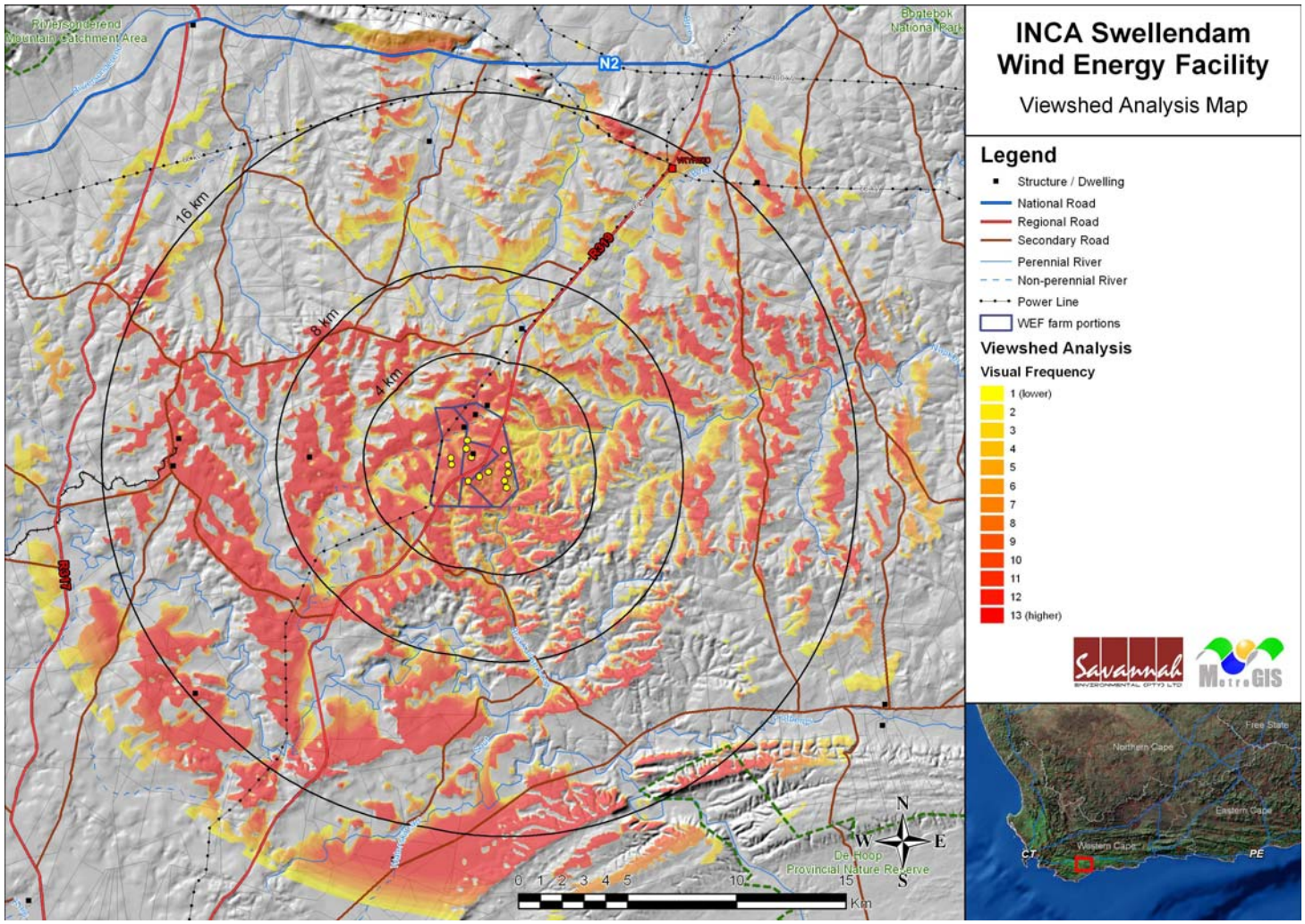

Figure 8.12: Viewer exposure for the Goereesoe Wind Energy Facility

Patches of highest frequency of potential visual exposure is spread through the whole study area but mostly occurs in the north-eastern and south-western sectors. Up to 13 turbines may be visible from within these areas, due to the location of the proposed turbines within the topography. The frequency of visual exposure is moderate to high in the northern sector, with 3-9 turbines potentially visible.

8.6.2 Visual Impact

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed wind farm are displayed on Figure 8.13. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values are 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 following is of relevance:

» Within a 4km radius of the proposed wind farm there are four farmsteads/structures located on the project site. Indications are that these structures will be incorporated into the development. Additional structures just beyond the project boundary have been indicated as sheds or storage facilities with no sensitive visual receptors present.
» A section of the R319 arterial road and part of a secondary road within a 4km radius of the proposed development has a potentially very high visual impact.
» The majority of the area (approximately 90%) within this zone will have a potentially high visual impact.
» Approximately 50% of the visually exposed zone between 4km and 8km will experience a moderate potential visual impact with sections of the R319 and other secondary roads within this zone having a high visual impact potential. One farmstead / structure occurs within this zone (located in the west of this zone) and would thus also have potential high visual impact.
» Within the 8km to 16km zone 3 of the 4 farmsteads / structures (all located within the western half of this zone) would have a potential moderate visual impact as well as sections of the R319 and other secondary roads occurring within this zone. Approximately 30% of the land in this zone would have a low potential visual impact. A small section of the De Hoop Provincial Nature Reserve also falls within this zone (south-western section of the zone) and would also have a potential moderate visual impact.

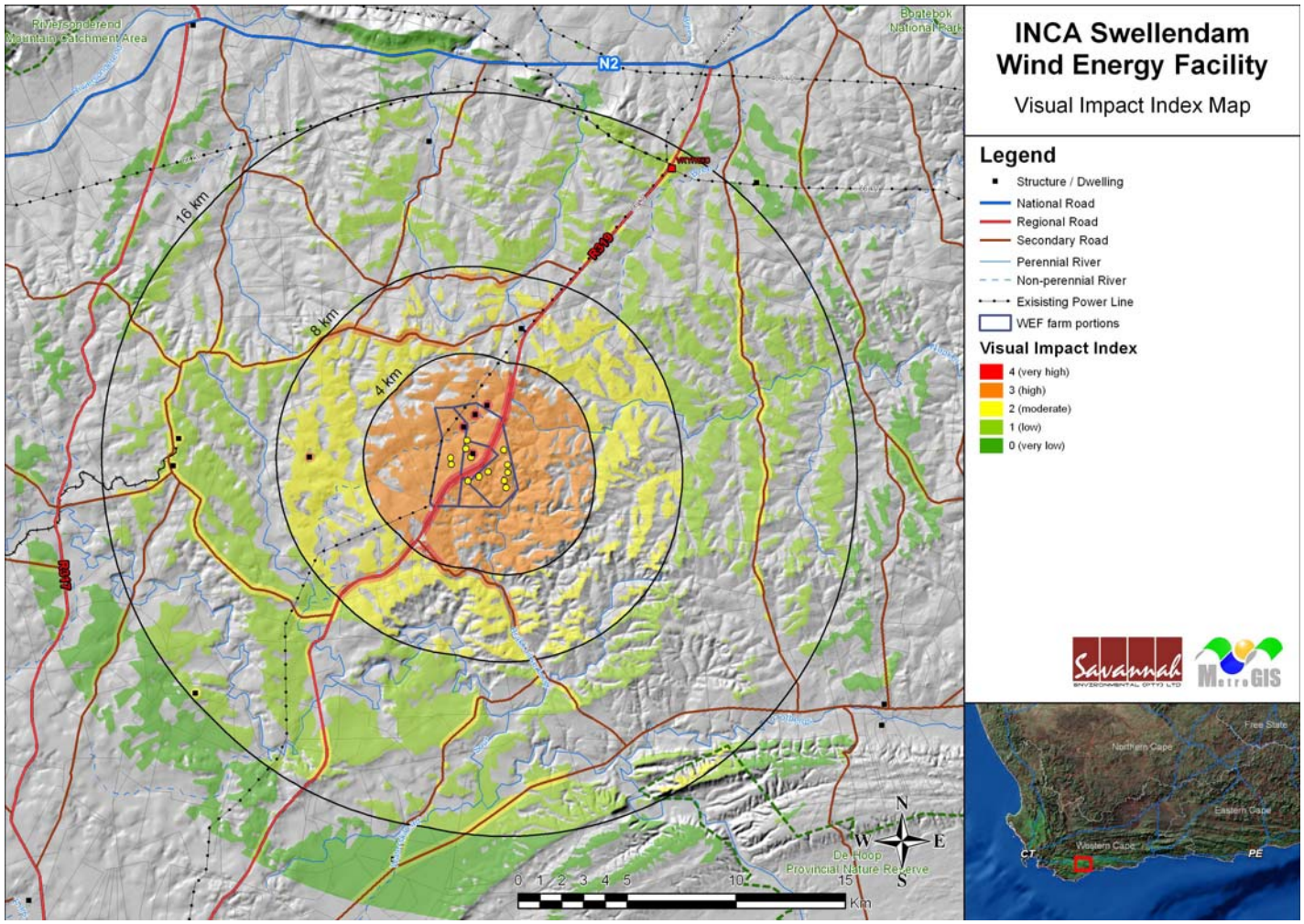

Figure 8.13: Visual Impact Index

» In the longer distance (i.e. beyond the 16km radius), visual exposure is further reduced in both extent and magnitude. Visual impacts are likely to be very low to negligible. Both the Riviersonderend Mountain Catchment Area and the Bontebok National Park fall within this zone.

8.6.3 Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Goereesoe Wind Energy Facility within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout provided by the developer.

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.

The panoramic overview allows for a more realistic viewer scale that would be representative of the distance over which the turbines are viewed. Where relevant, each panoramic overview indicates the section that was enlarged to show a more detailed view of the wind energy facility. 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.

Photo simulation view from Viewpoint 2 which is located along a secondary road on the 4km zone edge south of the proposed site: The point is located approximately 4km away from the nearest turbine. The viewing direction is north-easterly and is representative of a short to medium distance view that residents of and visitors to the area will experience while utilising the local secondary roads. A total of 12 turbines are fully or partially visible in the landscape. This view is typical of high frequency exposure (Refer to figure 8.15).

Refer to Visual report for other examples of photo simulations (Refer toAppendix K).

Figure 8.14.: Pre construction panoramic overview from Viewpoint 2.

Figure 8.15.: Post construction panoramic overview from Viewpoint 2.

8.6.4 Visual impact assessment: primary impacts

Impact Tables - visual impact of the wind energy facility

***Nature of Impact: Potential visual impact on observers travelling along arterial and secondary roads in close proximity to the proposed* wind farm** Potential visual impact on users of the R319 and secondary roads in close proximity of the proposed wind farm (i.e. within 8km) is expected to be of high significance. 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	Highly probable (4)	N/a
Significance	**High (72)**	**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?	No	
Mitigation: None.		
Cumulative impacts: The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

***Nature of Impact: Potential visual impact on residents of farmsteads in close proximity to the proposed* wind farm** The potential visual impact on residents of farmsteads within an 8km radius of the proposed wind farm is expected to be of high significance. 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	Highly probable (4)	N/a
Significance	**High (72)**	**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?	No	
Mitigation: None.		
Cumulative impacts: The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Potential visual impact on sensitive visual receptors within the region.

The visual impact on the users of roads and the residents of settlements and homesteads within the region (i.e. beyond the 8km 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	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?	No	N/a
Mitigation: None.		

Cumulative impacts: The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Impact Tables - visual impact of Ancillary infrastructure

***Nature of Impact: Potential visual impact of internal access roads on observers in close proximity to the proposed* wind farm**

Within the wind farm footprint, roads will be required to construct each turbine (construction phase) as well as to maintain the turbines (operational phase). Although existing roads will be used for the most part, these will require some upgrading and additional roads will need to be built. Such a network of roads has the potential of manifesting as 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, as they possess no height. This reduces the probability of this impact occurring. The table below illustrates the assessment of this anticipated impact, which is likely to be of low significance both before and after mitigation.

	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	

Mitigation:

Planning:

» Make use of existing roads wherever possible and plan the roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.
» Plan roads to avoid / minimise clearing of vegetation.

» Retain and maintain natural / cultivated vegetation in all areas outside of the development footprint. Construction: » Rehabilitate all construction areas. » Ensure that vegetation is not cleared unnecessarily to make way for the access roads. Operation: » Maintain roads to avoid erosion and suppress dust. » Use a paving material that blends in with the surrounding soil colours. Decommissioning: » Remove of infrastructure and roads not required for post decommissioning use and rehabilitate all cleared footprint areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of access roads will contribute to the cumulative visual impact of road infrastructure within the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the access roads are removed and rehabilitated. Failing this, the visual impact will remain.

***Nature of Impact: Potential visual impact of the on-site ancillary buildings on observers in close proximity to the proposed* wind farm**

The workshop / office and substation could present a visual impact as these are built structures within a natural context. In addition, vegetation will need to be removed for these structures to be built.

Although no dedicated viewshed has been generated for these structures, they will be located within the proposed facility footprint. This infrastructure is not likely to be as highly visible as the turbines as the height of the structures will be much lower. The anticipated visual impact is likely to be of low significance both before and after mitigation.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (28)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
Planning:

» Plan ancillary buildings in such a way to avoid / minimise clearing of vegetation. Consolidate ancillary infrastructure and favour already disturbed areas over undisturbed sites. » Retain and maintain natural / cultivated vegetation in all areas outside of the development footprint. Construction: » Rehabilitate all construction areas. » Ensure that vegetation is not cleared unnecessarily to make way for ancillary buildings. Operation: ➢ Maintain ancillary buildings. Decommissioning: » Remove infrastructure not required for post decommissioning use and rehabilitate all cleared footprint areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the workshop / office and substation will contribute to the cumulative visual impact of built structures within the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the workshop / office and substation are removed. Failing this, the visual impact will remain.

Impact Tables - visual impact of Lighting Impacts

Nature of Impact: Potential visual impact on of lighting at night on visual receptors in close proximity to the proposed wind farm

According to the proponent, no security or after hours lighting will be used during the operational phase of the facility. Therefore, glare from security lighting may be experienced during the construction phase only. This may have some significance for visual receptors in close proximity.

Another impact is that known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. Again, this impact is likely to be limited to the construction period only.

During operations, the only source of light will be 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 anticipated visual impact is likely to be of moderate significance both before and after mitigation.

	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?	Yes	

Mitigation:

Planning & operation:

» Limit aircraft warning lights for the proposed wind farm to the turbines on the perimeter, thereby reducing the overall requirement.
» Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).
» Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
» Make use of minimum lumen or wattage in fixtures.
» Make use of down-lighters, or shielded fixtures.
» Make use of Low Pressure Sodium lighting or other types of low impact lighting.
» Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Cumulative impacts:

The construction of 13 wind turbines for the wind farm and up to 42 turbines for the Excelsior WEF, with their aircraft warning lights and ancillary infrastructure with security and after hours lighting will increase the cumulative visual impact of lighting within the region.

Residual impacts:

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

Impact Tables - visual impact of Shadow Flicker

***Nature of Impact: Potential visual impact on of shadow flicker on visual receptors in close proximity to the proposed* wind farm** Shadow flicker occurs when the sky is clear, and when the rotor blades of the wind turbine 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 400m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring. There are no major roads or places of residence within this 300-400m buffer. The significance of shadow flicker is therefore anticipated to be low.		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	Low (4)	N/a
Probability	Very Improbable (1)	N/a
Significance	**Low (12)**	**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?	No	
Mitigation: N/a		
Cumulative impacts: N/a		
Residual impacts: None. The potential visual impact of shadow flicker will be removed after decommissioning and the removal of the wind turbines.		

Impact Tables - visual impact of Construction Impacts

***Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed* wind farm**

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. Dust from construction work could also result in potential visual impact. This anticipated impact is likely to be of moderate significance, and may be mitigated to low.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

» Retain and maintain natural vegetation in all areas outside of the development footprint.

Construction:

» Ensure that vegetation is not unnecessarily removed during the construction period.
» Reduce the construction period through careful logistical planning and productive implementation of resources.
» Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
» Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
» Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
» Rehabilitate all disturbed areas immediately after the completion of construction works.

Cumulative impacts:

None.

Residual impacts: None.

8.6.5 Visual impact assessment: secondary impacts

Impact Tables - visual impact of Wind Energy Facility and associated infrastructure

Nature of Impact: Potential visual impact on the visual character of the landscape and sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role.

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 picturesque and pastoral landscapes of the scenic Swellendam area.

The combination of the widespread, fragmented viewshed and the low frequency of sensitive receptors within the viewshed leads the author to the conclusion that the construction of 13 turbines within this context is likely to result in a partial loss of / alteration to the characteristics of the baseline environment with the introduction of elements that are prominent and partially uncharacteristic when set within the attributes of the receiving landscape.

The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be of moderate significance. There is no mitigation for this impact.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Probable (3)	N/a
Significance	**Moderate (45)**	**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?	No	
Mitigation: None.		
Cumulative impacts:		

The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

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

The greater study area has an inherent scenic value, especially the natural and topographical features (undulating topography and rivers).

The study area has a pastoral character and is located within a particularly picturesque part of the Western Cape. Nearby coastal towns enjoy status as holiday towns and tourist destinations and some of the inland homesteads and settlements may be expected to house overnight accommodation and other tourist amenities.

In addition, the coastline from Gordon's Bay to Pearly Beach (further to the west beyond the extent of the study area), forms the Cape Whale Coast Route. It is noteworthy, however, that the main access routes are not likely to be exposed to the potential visual impact.

The anticipated visual impact of the facility on existing tourist routes and destinations is expected to be of low significance. 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	Improbable (2)	N/a
Significance	**Low (26)**	**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?	No	N/a

Mitigation:
None.

Cumulative impacts:
The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations)

within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.

Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Potential visual impact of the proposed facility on conservation areas within the region.

Large areas within the broader study area have been given over to conservation, or remain in a natural state. A number of protected areas of differing status borders the study area. These protected areas, which include a National Park as well as provincial nature reserves and conservancies are not limited to those which have been formally proclaimed.

A negligible section of the De Hoop Provincial Nature Reserve will be visually impacted upon by the proposed wind farm, ancillary infrastructure and the power line.

Overall, the anticipated visual impact of the facility on conservation areas within the region is expected to be of low significance. There is no mitigation for this impact.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	Minor (2)	N/a
Probability	Highly probable (3)	N/a
Significance	**Low (27)**	**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?	No	N/a

Mitigation:
None.

Cumulative impacts:
The construction of 13 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the future construction of the authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.

Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.6.6 The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the facility (the wind turbines) is not possible to mitigate. Even though it is possible to reduce the height and / or number of turbines, this constitutes a change in the structure and potential feasibility of the proposed wind farm, it is not entertained as a viable possibility for mitigation. In this respect, it is assumed that the proposed turbines have been selected, designed and laid out on site to optimise the wind resource and cannot be reduced or altered.

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 therefore generally low or non-existent. The following mitigation is, however possible:

» It is recommended that vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.
» Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction / upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
» In terms of on-site ancillary buildings, it is recommended that the substation and workshop / office be planned so that clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.
» 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. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

» Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed wind farm and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:
    * Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    * Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    * Making use of minimum lumen or wattage in fixtures;
    * Making use of down-lighters, or shielded fixtures;
    * Making use of Low Pressure Sodium lighting or other types of low impact lighting.
    * Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
» Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:
    * Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    * Reduce the construction period through careful logistical planning and productive implementation of resources.
    * Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
    * Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
    * Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
    * Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
    * Restrict construction activities, whenever possible, to daylight hours in order to negate or reduce the visual impacts associated with lighting.
    * Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.
» During operation, the maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.

» Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.
» 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. An ecologist should be consulted to give input into rehabilitation specifications.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» Secondary impacts anticipated as a result of the proposed wind farm (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on tourist routes, tourist destinations and conservation areas within the region.

Where sensitive visual receptors are likely to be affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or even the construction of screens. Ultimately, visual screening is most effective when placed as close to the receptor self.

Good practice requires that the mitigation of both primary and secondary visual impacts as listed above be implemented and maintained on an on-going basis.

8.6.7 Cumulative impacts

Four other known wind energy facility sites are located within the Overberg District Municipality and in proximity to the proposed Goereesoe Wind Energy Facility (refer to table 8.1).

The construction of 13 additional wind turbines and associated infrastructure will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the possible future construction of the already authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.

Figure 8.2 shows the potential cumulative visual impact of the proposed Goereesoe Wind Energy Facility as well as the other proposed wind energy facilities in the area, including the authorised and preferred bidder Klipheuwel/ Dassiesfontein Wind Energy Facility (located to the west).

8.6.8 Visual Impact of the Power Line

Nature of Impact: Potential visual impact of the overhead power line on observers in close proximity thereto

The construction of the overhead power line could represent a visual impact. In addition to the power lines themselves, the alignment will require a cleared area at each pole footprint.

Although no dedicated viewshed has been generated for the connecting power line to the main grid, it will be located within the proposed facility footprint. This infrastructure is not likely to be as highly visible as the turbines, as the height of the structures will be much lower. The anticipated visual impact is likely to be of moderate significance both before and after mitigation.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Moderate (42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

» Retain and maintain natural / cultivated vegetation in all areas outside of the development footprint.

Construction:

» Rehabilitate all construction areas and servitudes.

» Ensure that vegetation is not cleared unnecessarily to make way for the power line and servitude and / or access road.

Operation:

» Maintain servitudes to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure not required for post decommissioning use and rehabilitate all cleared footprint areas.

Cumulative impacts:

The construction of the power line will contribute to the cumulative visual impact of electrical infrastructure such as power lines and substations within the region. This impact will, however be limited due to the limited extent of both existing and proposed infrastructure.

Residual impacts:

The visual impact will be removed after decommissioning, provided the power lines are removed. Failing this, the visual impact will remain.

8.6.9 Conclusions and Recommendations

The construction and operation of the proposed Goereesoe Wind Farm and its associated infrastructure will have a visual impact on the visual environment. However, the facility has an advantage over other more conventional power generating plants (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers. The facility further has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants.

However, these positive aspects should not distract from the fact that the proposed intervention would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, residents of rural homesteads and settlements and tourists passing through, visiting or holidaying in the region.

The study area has a pastoral character and is located within a particularly picturesque part of the country. The character of the landscape is one of undeveloped, wide open spaces. The visual quality is high and is characterized by pastoral landscapes and undulating topography.

Coastal towns just beyond the study area enjoy status as holiday towns and tourist destinations and some of the inland homesteads and settlements may be expected to house overnight accommodation and other tourist amenities. In addition, the coastline from Gordon's Bay to Pearly Beach (further to the west beyond the extent of the study area) forms the Cape Whale Coast Route.

A number of mitigation measures have been proposed as described earlier in this section, which, if implemented and maintained, will reduce the significance of the certain visual impacts associated with the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts are considered to be within acceptable limits. The anticipated visual impacts of high significance (i.e. where high frequencies of visual exposure correspond with sensitive visual receptors) are quite limited in extent.

Even though the facility may appear to be quite prominent in the landscape, the facility would be considered to be acceptable from a visual perspective.

The finding of the Visual Impact Assessment undertaken for the Proposed Goereesoe Wind Farm is that the visual environment surrounding the majority of the study area around the site will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

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

» The potential visual impact of the facility on observers travelling along arterial and secondary roads in close proximity to the proposed facility (i.e. within 8km) will be of high significance.
» The anticipated visual impact on residents of settlements and homesteads within an 8km radius of the proposed facility will be of high significance.
» Within the greater region (i.e. beyond 8km from the proposed facility), the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of settlements and homesteads) will be of moderate significance.
» In terms of ancillary infrastructure, the anticipated visual impact of the access roads, workshop / office and substation will be of low significance.
» The anticipated visual impact of the proposed power lines will be of moderate significance in close proximity to the proposed facility.
» Anticipated visual impacts related to shadow flicker will be of low significance.
» Anticipated visual impact of lighting will be of moderate significance.
» The visual impact of construction is 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.
» In terms of secondary visual impacts, the significance of the anticipated impact on tourist routes and tourist destinations will be of low significance, as will the anticipated impact on.
» The visual impact on conservation areas within the region is also likely to be of low significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) are mostly of moderate or low significance. Anticipated visual impacts on sensitive receptors in close proximity to the proposed facility remain high, but are, nonetheless not considered to be fatal flaws for the proposed wind farm.

The main consideration in this regard is the small scale of the proposed wind farm and the fact that limited tourist routes, coastal holiday towns and conservation areas are likely to be affected. Further to this, the wind farm is located adjacent to the already authorised Excelsior WEF (up to 42 wind turbines) and will likely appear as an extension of the latter, rather than a stand-alone wind energy facility.

In addition, the anticipated visual impacts of high significance (i.e. where high frequencies of visual exposure correspond with sensitive visual receptors) are quite limited in extent.

Considering all factors, it is recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures and management programme.

Where sensitive visual receptors are likely to be affected (i.e. residents of farmsteads in close proximity), it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or even the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

8.7 Assessment of Potential Noise Impacts

8.7.1 Relevant Noise Receptors

Potential noise-sensitive development are illustrated Figure 8.16 as green dots, with localities defined in Table 8.3. The town of Swellendam is located approximately 30 km from the closest wind turbine in this development, and the development therefore poses no noise risk to this town.

Table 8.3: Locations of the identified noise-sensitive developments (Datum type: WGS84 – Hartbeeshoek)

Noise-sensitive development	*Assumed* status of structure	Location (Latitude)	Location (Longitude)	Est. distance to closest turbine (m)
NSD01	Residential	-34.251559°	20.232990°	1,200m
NSD02	Residential	-34.247178°	20.239014°	1,800m
NSD03	Residential	-34.256084°	20.226845°	600m
NSD04	Residential	-34.237586°	20.246918°	3,100m
NSD05	Residential	-34.249267°	20.201604°	2,800m
NSD06	Residential	-34.255156°	20.234185°	850m

It should be noted that there are a number of dwellings close to wind turbines 1 and 2 (as seen from Google Earth® maps) that are not indicated as an NSD based on the findings of the Scoping report of Safetech. These dwellings have also been indicated by the main consultants (Savannah Environmental (Pty) Ltd)) as a storage area, and not a residential dwelling.

8.7.2 Noise from Construction activities

Noise sources during construction include the following:

» Establish internal access roads - the internal road alignment is governed by the positioning of the wind turbines;
» Site preparation activities will include clearance of vegetation at the footprint of each turbine. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site;
» Construct foundations – it is expected that the volume of concrete required for each turbine foundation will be in the order 300 - 800 m^3. Due to the volume of concrete that will be required, an on-site batching plant could be required to ensure a continuous concreting operation. The source of aggregate is yet undefined;
» Transport of components & equipment to site – all components will be brought to site in sections by means of flatbed trucks. Additionally, components of various specialised construction and lifting equipment are required on site to erect the wind turbines and will need to be transported to site. The typical civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.). The components required for the establishment of the overhead power line (including towers and cabling) will be transported to site as required.

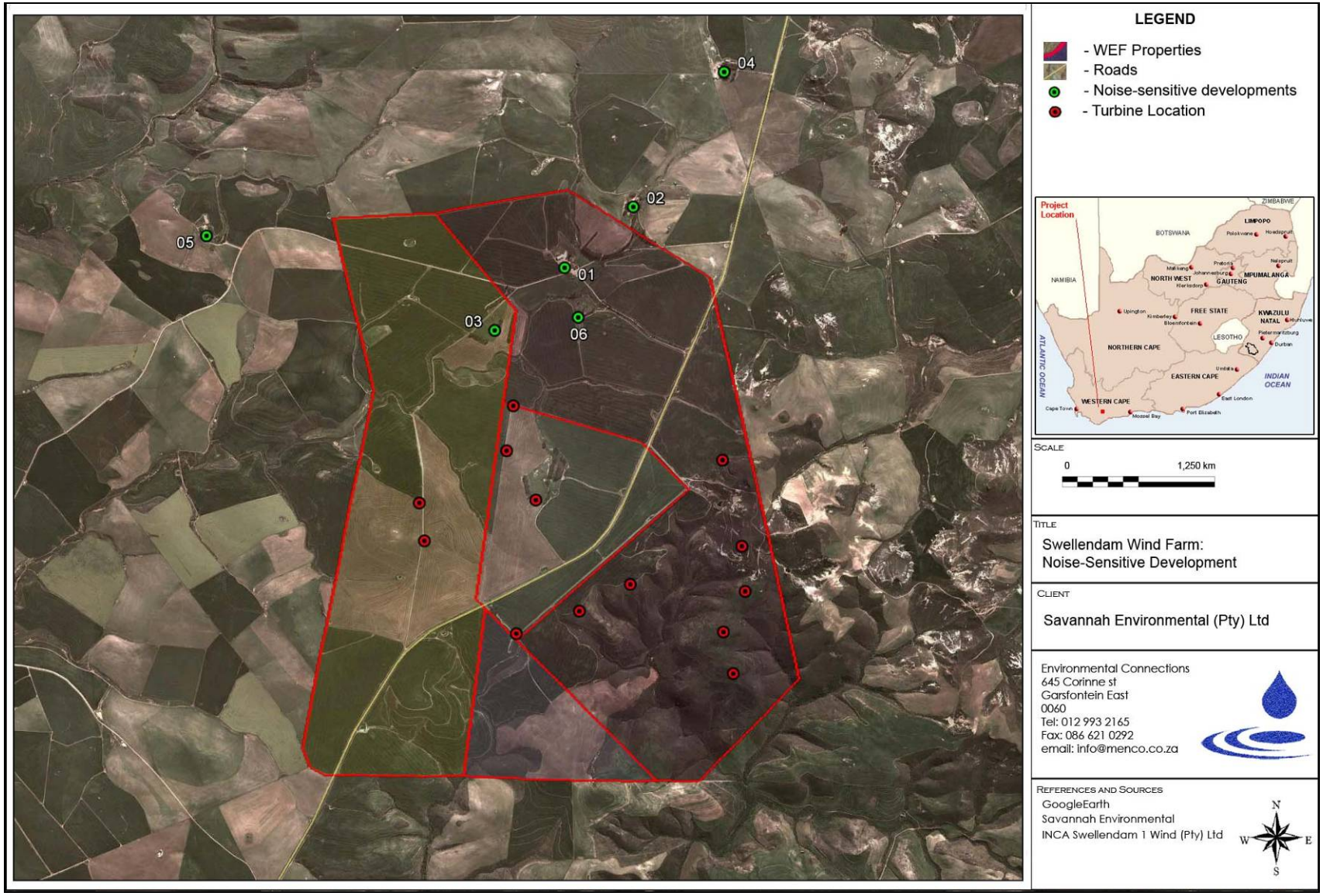
04
02
05
01
03
06
LEGEND
- WEF Properties
- Roads
- Noise-sensitive developments
- Turbine Location
Project Location
ZIMBABWE
BOTSWANA
NAMIBIA
LIMPOPO
NORTH WEST
MPUMALANGA
GAUTENG
FREE STATE
KWAZULU NATAL
LESOTHO
NORTHERN CAPE
EASTERN CAPE
WESTERN CAPE
ATLANTIC OCEAN
INDIAN OCEAN
SCALE
0
1,250 km
TITLE
Swellendam Wind Farm:
Noise-Sensitive Development
CLIENT
Savannah Environmental (Pty) Ltd
Environmental Connections
645 Corinne st
Garsfontein East
0060
Tel: 012 993 2165
Fax: 086 621 0292
email: info@menco.co.za
REFERENCES AND SOURCES
GoogleEarth
Savannah Environmental
INCA Swellendam 1 Wind (Pty) Ltd
N
W
E
S

Figure 8.16: Aerial image indicating potential noise sensitive receptors and property boundaries for the Goereesoe Wind Energy Facility

» Establishment of laydown & hard standing areas - laydown areas will need to be established at each turbine position for the placement of wind turbine components. Laydown and storage areas will also be required to be established for the civil engineering construction equipment which will be required on site. Hard standing areas will need to be established for operation of the crane. Cranes of the size required to erect turbines are sensitive to differential movement during lifting operations and require a hard standing area;
» Erect turbines - a crane will be used to lift the tower sections into place and then the nacelle will be placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor 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 the large crane will be needed to put it in place;
» Construct substation - the underground cables carrying the generated power from the individual turbines will join at the substation. The construction of the substation would require a site survey; site clearing and leveling and construction of access road/s (where required); construction of a substation terrace and foundation; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas;
» Establishment of ancillary infrastructure - A workshop as well as a contractor's equipment camp may be required. The establishment of these facilities/buildings will require the clearing of vegetation and leveling 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;
» Connection of wind turbines to the substation - each wind turbine will be connected to the on-site substation via electrical cables, to be lain underground where possible. The installation of these cables will require the excavation of trenches of approximately 1 m deep within which they can then be laid. The underground cables will be planned to follow the internal access roads, where possible;
» Construction of an overhead **power line** to connect to the Eskom's infrastructure; and
» Site rehabilitation - once construction is completed and once all construction equipment is removed, the site will be rehabilitated where practical and reasonable.

The equipment likely to be required to complete the above tasks will typically include:

» excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flatbed truck(s), pile drivers, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.

Material supply: Concrete batching plants and use of Borrow Pits

There exist three options for the supply of the concrete to the development site. These options are:

1. The transport of "ready-mix" concrete from the closest centre to the development.
2. The transport of aggregate and cement from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities. This would most likely be a movable plant.
3. The establishment of a small quarrying activity, where aggregate will be mined, crushed and screened and used onsite. Cement will still be transported to the site, where there will be a small movable concrete batching plant.

For the purpose of the EIA, Option 2 was assumed as being the preferred option. Aggregate will be sourced from existing commercial borrow pits in the area.

However, should the developer select the development of borrow-pits on-site (option 3); the findings of this EIA will still be valid. This is because of the borrow-pit will not be operated 24 hours a day, it is generally a very temporary activity (a few weeks), and the likelihood that it may impact on the NSD is remote.

Blasting

Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered during the EIA phase for the following reasons:

» Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.
» People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.
» Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relative fast results in a higher acceptance of the noise. Note that with the selection of explosives and blasting methods, noise levels from blasting is relatively easy to control.

Traffic

A significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the wind turbine.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

Results of Noise Modelling – Construction Noise

Only the calculated daytime ambient noise levels are presented, as construction activities that might impact on sensitive receptors should be limited to the 06:00 – 22:00 time period. The worst case scenario is presented with all activities taking place simultaneously at each proposed wind turbine location during wind-still conditions, in good sound propagation conditions (20^{o}C and 80% humidity).

Even though construction activities are projected to take place only during day time, it might be required at times that construction activities take place during the night (particularly for a large project). Below is a list (and reasons) of construction activities that might occur during night time:

» Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
» Working late due to time constraints: Weather plays an important role in time management in construction. A spell of bad weather can cause a construction project to fall behind its completion date. Therefore it is hard to judge beforehand if a construction team would be required to work late at night.

As it is unknown where the different activities may take place, it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6 dBA cumulative noise impact) at all locations where wind turbines may be erected, calculating how this may impact on potential noise-sensitive developments as well as mapping this modelled construction activity over distance. Overall, noise impacts during construction will have a low impact on the identified potential noise-sensitive receptors.

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

Nature of Impact: Numerous simultaneous construction activities that could impact on receptors. ***Acceptable Rating Level***: Rural district with little road traffic (excluding construction traffic): 45 dBA outside during day. Use of $L_{Req,D}$ of 45 dBA for rural areas. Ambient sound level = 28 dBA.		
	No mitigation	***Mitigation considered***
Extent (ΔLAeq,D>7dBA)	**Local (2)** – Change in ambient sound levels would not extend further than 1,000 meters from activities.	*not required.*
Duration	**Temporary (1)** – Impacts are predicted to be of short duration (portion of construction period) and intermittent/occasional.	*not required.*
Magnitude	**Low (2)** to **High (10) -** ambient noise levels <Rating Level.	*not required.*
Probability	**Improbable (1)** to **Possible (2**) - Due to change in ambient sound levels there is a possibility that **NSD03** may complain.	*not required.*
Significance	**Low (5** to**26).**	**n/a**
Status (positive or negative)	Negative.	n/a
Reversibility	High.	n/a
Irreplaceable loss of resources?	Not relevant.	n/a
Can impacts be mitigated?	*Yes, though mitigation not required.*	
Mitigation: » *Not required.*		
Cumulative impacts: This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.		
Residual impacts: This impact will only disappear once construction activities cease.		

8.7.3 Noise Sources: Operational Phase

Noise emitted by wind turbines can be associated with two types of noise sources:

» Aerodynamic sources: due to the passage of air over the wind turbine blades; and
» Mechanical sources that are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources generally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise.

» **Noise from the Wind Turbines: Aerodynamic sources[13]**
Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:
  * Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge
  * Noise due to inflow turbulence (turbulence in the wind interacting with the blades)
  * Discrete frequency noise due to trailing edge thickness
  * Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade)
  * Noise generated by the rotor tips

These types of noise are discussed in more detail in the Noise Impact Assessment report contained in Appendix M.

Results of Noise Modelling – Operational Phase

The noise study focuses on the impacts on the surrounding sound environment during times when a quiet environment is highly desirable. Noise limits are therefore appropriate for the most noise-sensitive activity, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc).

Appropriate Zone Sound Levels are therefore important, yet it has been shown that the SANS recommended (fixed) Night Rating Level ($L_{Req,N}$ = 35dBA) might be inappropriate due to the increased ambient sounds relating to wind action. A more appropriate method to determine the potential noise impact would be to make use of the projected noise levels due to the operation of the WEF as well as the likely ambient sound levels due to wind induced noises.

[13] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996*

Table 8.4: Operation: Defining noise impact on Receptors (dBA) without any mitigation (at a 7 m/s wind speed)

Receptor	Estimated Night-time Ambient Sound Level	Night Noise Level[14]	Change From ambient sound level	Defining Significance of Noise Impact				
				Magnitude	Duration	Extent	Probability	Significance
NSD01	39.00	41.35	2.35	2 (minor)	4 (long term)	2 (local)	1 (very improbable)	8
NSD02	39.00	40.28	1.28	2 (minor)	4 (long term)	2 (local)	1 (very improbable)	8
NSD03	39.00	44.09	5.09	6 (moderate)	4 (long term)	2 (local)	3 (probable)	36
NSD04	39.00	39.53	0.53	2 (minor)	4 (long term)	2 (local)	1 (very improbable)	8
NSD05	39.00	39.61	0.61	2 (minor)	4 (long term)	2 (local)	1 (very improbable)	8
NSD06	39.00	42.65	3.65	4 (low)	4 (long term)	2 (local)	2 (improbable)	20

Note that the status of the receptors in Table 8.4 is based on the study *"Noise Impact Assessment of the Proposed Wind Farm on Goereesoe, Swellendam in the Western Cape Province"*. Investigations conclude that there is a ***medium*** risk of a noise impact developing at **NSD03** during the operational phase.

The C-weighted sound power levels were also evaluated and calculated to range between 40 and 60 dBC at the different receptors with a 7 m/s wind. At the wind speeds measured ambient C-weighted sound levels (due to wind) is likely to exceed the projected C-weighted sound levels and the risk of low-frequency issues is low.

[14] Noise level was calculated using the ISO methods discussed in this report.

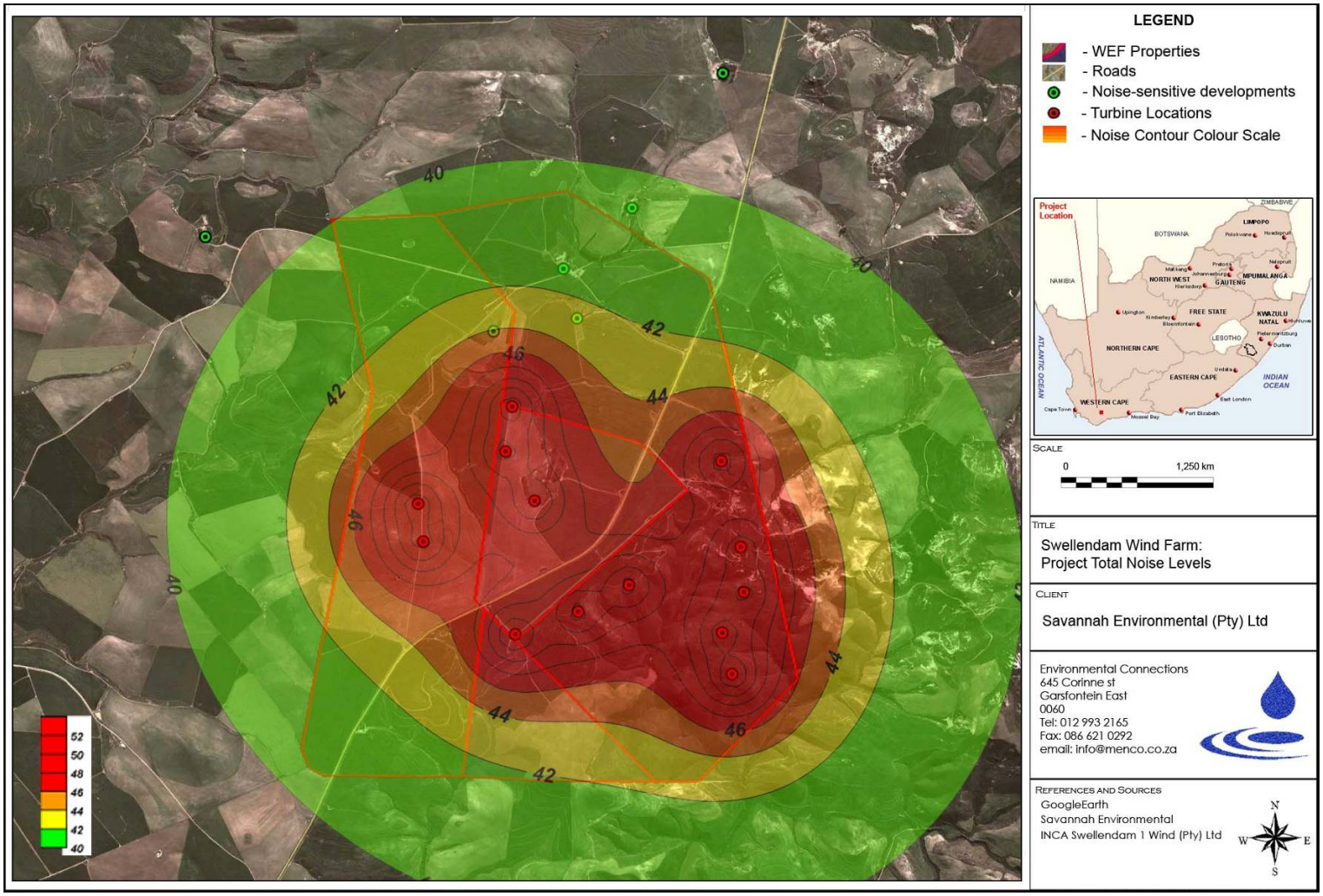

Figure 8.17: Projected Night-time Noise Levels (ISO model) from the wind energy facility; Contours of constant sound levels for a 7 m/s wind

The change in ambient sound levels is illustrated in **Figure 8.18**

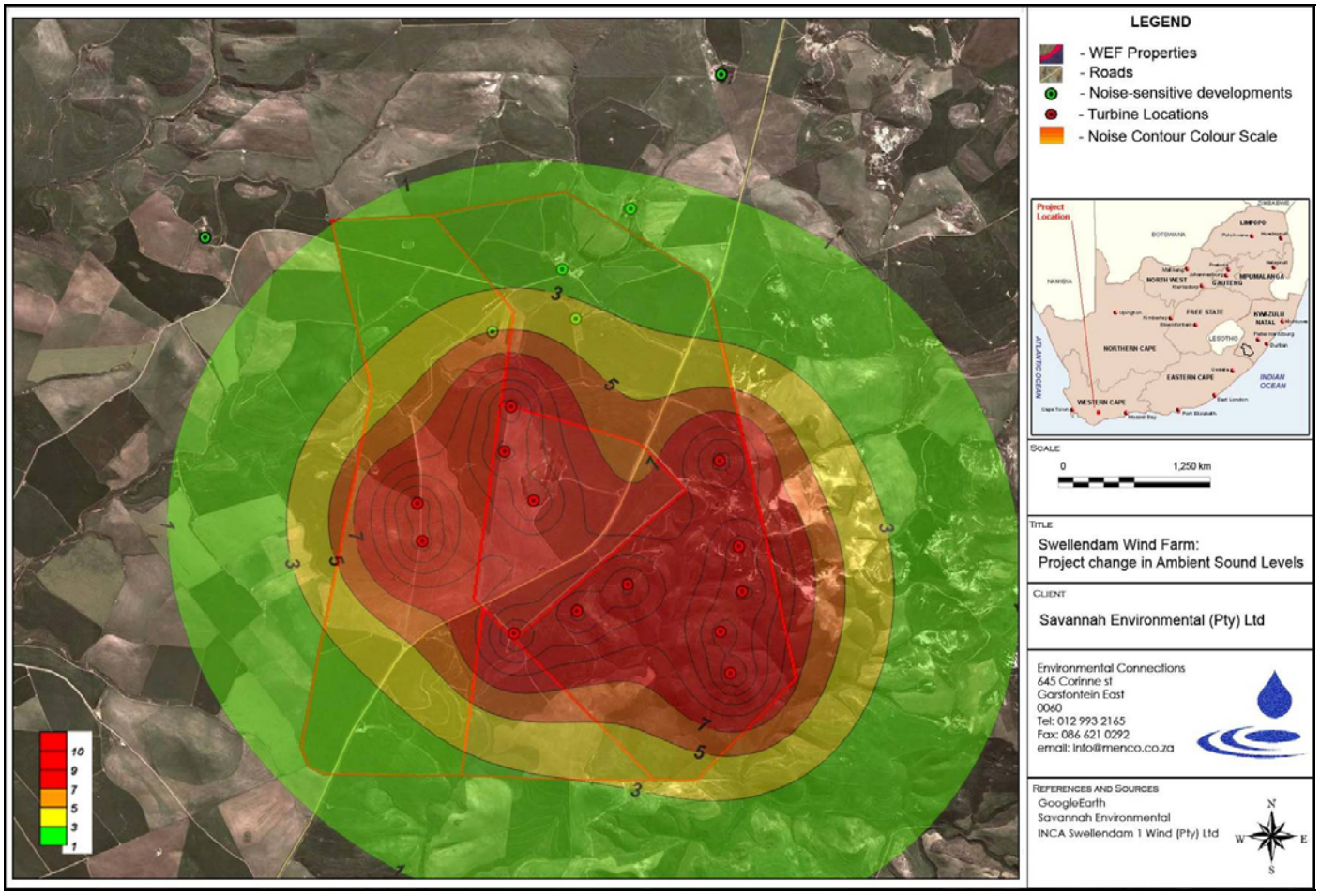

Figure 8.18: Projected change in ambient sound levels (ISO model); Contours of constant sound levels for a 7 m/s wind

Impact tables summarising the significance of noise impacts (without mitigation) from the wind turbines – operational phase

Nature of Impact: Numerous turbines operating simultaneously during a period when a quiet environment is desirable. ***Acceptable Rating Level***: Rural district with little road traffic. Refer to Table 5-6 of Noise Report (Appendix M) for the proposed Night Rating Level that varies with wind speed.		
	No mitigation	***Mitigation considered***
Extent (ΔLAeq,D>7dBA)	Rural district with little road traffic. Refer to Table 5-6 of Noise Report (Appendix M) for the proposed Night Rating Level that varies with wind speed.	-
Duration	**Local (2)** – The impact could affect the local area (within 1,000 m from site).	-
Magnitude	**Long term (4)** – Impacts that will continue for the life of the Project, but ceases when the Project stops operating.	-
Probability	**Low (2)** to **Medium (6) -** See Table 8.4 ambient noise levels.	-
Significance	**Improbable (1)** to **Likely (3**) – The increase above the wind induced ambient noise levels at **NSD03** will barely exceed 5 dBA during a worst-case scenario.	**-**
Status (positive or negative)	**36 (Medium) –** for **NSD03. 8 - 20 (Low) –** for all other **NSD's.**	-
Reversibility	High.	-
Irreplaceable loss of resources?	*Not relevant.*	-
Can impacts be mitigated?	*Yes.*	

Mitigation:

The significance of the noise impact is considered to be of a medium significance at NSD03. The developer must discuss the projected noise level with NSD03, and if the projected noise level is unacceptable to this receptor mitigation as presented below is recommended:

» Most wind turbine model allows the operation of the turbine in a quieter mode. If a noise complaint is registered from NSD03 the closest wind turbine could be operated in a quieter mode as recommended by the manufacturer.
» The use of quieter wind turbine (no. 03) near NSD03. It is important to note that this assessment made use of a worse-case scenario wind turbine that could generate relative high noise levels (3.0MW);
» The relocation of the NSD03, this option is left exclusively to the developer. The status of dwellings in this study made use of information from Safetech Environmental Health and Safety: "Noise Impact Assessment of the Proposed Wind Farm on Goereesoe, Swellendam in the Western Cape Province", conducted on31st October 2011 ; and
» Relocating turbine 03 further away from NSD03, or the complete removal of this turbine.

Further statements are included in this report for the developer to note, and includes:

» Good public relations are essential. At all stages surrounding receptors should be educated with respect to the sound generated by wind turbines. The information presented to stakeholders should be factual and should not set unrealistic expectations. It is counterproductive to suggest that the wind turbines will be inaudible, or to use vague terms like "quiet". Modern wind turbines produce a sound due to the aerodynamic interaction of the wind with the turbine blades, audible as a "swoosh", which can be heard at some distance from the turbines. The magnitude of the sound will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the wind turbines and the ambient background sound level.
» Community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. Wind projects offer a benefit to the environment and the energy supply for the greater population, and offer economic benefits to the land owners leasing installation sites to the wind farm. 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.
» The developer must implement a line of communication (i.e. a help line where complaints could be lodged. All potential sensitive receptors should be made aware of these contact numbers. The Wind Energy Facility should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop. For example, sudden and sharp increases in sound levels could result from mechanical malfunctions or perforations or slits in the blades. Problems of this nature can be corrected quickly, and it is in the developer's interest to do so.

Cumulative impacts:
This impact is cumulative with existing ambient background noises.
Residual Impacts:
This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

8.7.4 Comparative Assessment of Substation and Power Line Alternatives

Transformer noises (Substation)

Also known as magnetostriction; this is when the sheet steel used in the core of the transformer (substation) tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations are taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" takes place 100 times a second, resulting in a tonal noise at 100Hz. This is normally not an issue if the substation is further than 200 meters from a potentially sensitive receptor. This is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer equipment.

Transmission Line Noise (Corona noise)

Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires of power lines. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions as provided by fog or rain. A minimum line potential of 70 kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but fortunately it is generally only a feature during fog or rain.

Corona discharges results in:

» Power losses
» Audible noises
» Electromagnetic interference
» A purple glow
» Ozone production
» Insulation damage

In addition this is associated with high voltage transmission lines, and not the lower voltage distribution lines proposed for construction by the developer.

As such, Electrical Service Providers (such as Eskom) goes to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relative short duration compared to other operational noises. At the relative low voltages proposed for this project Corona noises would not be an issue.

Both alternatives are located away from sensitive receptors and are therefore both considered to be acceptable.

8.7.5 Cumulative impacts

The development of the Excelsior WEF to the north of the Goereesoe Wiind Farm may result in a slight cumulative noise impact at NSD03 and NSD06. The magnitude of this cumulative impact is estimated to be less than 1 dB due to the distance of these noise-sensitive developments from the closest wind turbines of the Excelsior WEF (more than 1,000 meters). This 1 dB increase will not change the magnitude of the impact nor the probability of the noise impact occurring and the significance of the noise impact will remain a low-medium (36).

Similarly, depending on the exact location of the closest wind turbines of the Excelsior WEF the potential noise impact at NSD01 and NSD08 may increase. The increase could range between 1 and 2 dB and could raise the magnitude of the noise impact to a low-medium (4) from a low, and potentially increase the probability of the noise impact occurring from an unlikely to a possible. This however will not increase the significance of the noise impact from the current low (at NSD01 and NSD08).

8.7.6 Conclusions and Recommendations

The noise study for the proposed Swellendam Wind Energy Facility south-west of the town of Swellendam, made use of sound propagation models to predict noise impacts and identify issues of concern.

With the input data as used, this assessment indicated that the potential noise impact would be insignificant during the construction phase. However a ***medium*** significance has been identified at receptor **NSD03** during the operational phase. Measures that could be considered before the development of this wind energy facility would include:

» The operation of the wind turbine in a quieter mode (if the turbine is capable of this measure);
» The use of quieter wind turbine (no. 03) near **NSD03**; *or*
» The relocation of the **NSD03**; *or*
» Relocating of turbine 03 further away from **NSD03,** or the complete removal of this turbine.

The removal of turbine 03 further away from receptor **NSD03** will reduce the noise impact significance from a ***medium*** to a ***low*** at this receptor.

It should be noted that the noise impact was determined based on the outcome of a regression analysis that indicated that the likely long-term ambient sound levels could be significant during periods when wind speeds exceeds 4 m/s. The regression analysis is based on a number of measurements taken at various sites in South Africa during windy conditions and little other noise sources.

It is recommended that the developer implement an ambient sound measurement programme at **NSD03** before the development of the WEF. These measurements should be taken in 10-minute bins for a period of not less than 72 hours. This data should be co-ordinated with the mast wind speed (as calculated for the 10 meter height wind speed).

Quarterly noise measurements are recommended for the first year of operation. Noise measurements are recommended at **NSD03** over a period of at least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer.

If a valid and reasonable noise complaint is registered relating to the operation of the facility additional noise monitoring should be conducted by an acoustic consultant during the quarterly noise measurements. Noise monitoring must be continued as long as noise complaints are registered.

The developer should re-evaluate the layout if any wind turbines are added within 1,000 meters from any NSD, or the layout changed in such a manner where wind turbines are moved closer to any NSD.

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

With its potential for environmental and economic advantages, wind power generation has significant potential to become a large industry in South Africa. However, when wind farms are near to potential sensitive receptors, consideration must be given to ensuring a compatible co-existence. The potential sensitive receptors should not be adversely affected and yet, at the same time the wind farms need to reach an optimal scale in terms of layout and number of units.

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 can impact on areas at some distance away. When potentially sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not cause undue 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 not be audible 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.

8.8 Assessment of Potential Traffic Impacts

The expected effects of traffic that would be generated by the proposed development during peak hours were analysed as follows:

» The background traffic volumes were determined for the study network in the vicinity of the site. These are the traffic volumes that would be on the road network in the absence of the proposed development (No go Alternative);
» A growth factor was applied to account for regional growth
» Construction Phase Traffic
» Site-generated trips were estimated for the proposed development;
» The construction phase traffic and the assigned site-generated traffic from the proposed development were added to the background traffic volumes to determine the total traffic conditions with the development completed.

Year 2014 Background Traffic Conditions (No go alternative)

For the purposes of this study, year 2015 background traffic conditions were developed by applying a 3% *annual traffic growth rate* to the existing traffic on the major links. This estimated growth rate was assumed to allow for the additional traffic volumes that will be generated by other in-process and future developments in the vicinity of the proposed development.

Due to the low traffic volumes the current road network will continue to operate at acceptable levels-of-service during the background conditions.

Construction Phase

A large amount of traffic will be generated during the construction phase. The following activities will probably occur during the construction phase:

» Construction of the internal access roads,
» Stripping and stockpiling of topsoil,
» Excavation and construction of the foundations for the wind turbines,
» Construction of the operations building,
» Erection/Assembly and disassembly of the cranes
» Assembly of the towers, nacelles and blades,
» Trenching for cabling and
» Reinstatement of the site.

The internal access roads will be constructed mainly of local materials sourced on site and these roads will be retained and used for inspection and maintenance of the wind turbines.

The tower foundations are large reinforced concrete footings. It is assumed that the material removed during excavation will be utilised within the site to create hardstand areas for the cranes and in reinstating the site after construction. It is assumed that the concrete will be mixed on site and the raw materials will be transported to the site via the existing road network. It is assumed that up to 70 truck loads will be required for each foundation.

Approximately 20 heavy truck loads are required per site to assemble and disassemble the cranes.

The components of the wind turbines will be transported to the site from either Cape Town harbour or Saldanha Bay harbour and approximately 12 abnormal truck loads are required per wind turbine.

Trip Generation

Estimates of the peak hour vehicle trips for new developments are typically based on empirical observations at similar land uses. The estimates summarised in Table 8.5 are based on information sourced from other similar projects and it is also based on the assumption that the proposed 13 wind turbines will be constructed over a 12 month period. These assumptions are considered the worst case scenario.

Table 8.5: Expected Generated Truck Trips during the Construction Phase

Material	Approximate Number of Trucks required
Foundation	1 050
Construction Cranes	40
Tower Sections	75
Nacelles	45
Blades	45
Switch Cabinets	30
TOTAL	**1 285**

It is expected that approximately 1 285 trucks will be required during the 12 month construction period, working approximately 300 days of the year. This means that, on average, approximately 5 trucks will visit the site per day which equates to approximately 10 truck trips spread over an eight hour day.

Based on information sourced from other similar projects it is assumed that approximately 200 construction workers could be employed during the peak construction period. It can be expected that the bulk of these workers will commute to/from the construction site via bus or minibus taxis. If 70% of the construction staff travels by minibus taxis with an average occupancy of 12 passengers per vehicle, this equates to approximately 12 taxis visiting the site in the morning and afternoon peak hours. If the remaining 30% travel with private vehicles, it equates to approximately 80 motor vehicle and truck trips during the average week day peak hours.

It is expected that approximately 20 permanent staff members will be employed at the proposed development during the operational phase. If all of them travel to work with their private vehicles it means 20 trips in during the a.m. peak hour and 20 trips out during the p.m. peak.

Trip Distribution and Assignment

It is expected that all of the trips to/from the proposed wind farm will come from the N2 via the R319. The trucks delivering the wind turbine components will come from the direction of Swellendam via the R319 and most of the trucks delivering raw material for the wind tower foundations and road construction material will come from the Swellendam area.

Proposed Road Network Upgrades

Based on the expected number of construction trips generated by the proposed development, the existing road network has sufficient capacity to accommodate the additional trips from an operational perspective.

Operational Phase

The operational phase of this project is not expected to generate significant traffic volumes. The typical day-to-day activities will probably only be service vehicles undertaking general maintenance at the site. The number of permanent staff on site is not expected to be more than 20 people and therefore no additional upgrades are required to accommodate the operational site traffic.

8.9.1. Conclusions and Recommendations

The Traffic Impact Assessment report summarises the existing transportation conditions within the site vicinity and provides an assessment of the transportation impacts of the proposed development on the surrounding transportation system. The traffic impact analysis resulted in the following conclusions and recommendations.

Existing Traffic Conditions

» The current demand on the existing road network in the site vicinity is low and the road network and intersections operate at acceptable levels of service.
» A growth rate of 3 percent per annum was applied to the existing traffic volumes to determine the 2015 background traffic conditions.
» All the intersections and roadways will continue to operate at acceptable levels-of-service in the future during the worst peak hours of the year with the proposed development.

Construction Phase

» It is expected that the construction phase of the proposed development could generate approximately 80 vehicular trips during the average weekday of which approximately 20 percent will be heavy truck traffic.
» Access to the site is proposed via four existing farm accesses off the R319 at KM35.20, KM35.96, KM36.67 and KM39.18.

Operational Phase

» The operational phase of this project is not expected to generate significant traffic volumes. The typical day-to-day activities will probably only be service vehicles undertaking general maintenance at the site. The number of permanent

staff on site is not expected to be more than 20 people and therefore no additional upgrades are required to accommodate the operational site traffic.

8.9 Assessment of Potential Impacts on Heritage

No grave sites/ burial grounds were noted anywhere on the site. Various farm roads, the alignment of which seems to correspond with that of roads noted on early mapping, were noted by the heritage specialist (Refer to figure 8.19 for recent aerial photography for the study area).

Pre-Colonial:

Archival sources relating to pre-colonial history for the farm Goereesoe and its environs were not available. However, secondary sources suggest that the region between the Hottentots Holland Mountains and Keurbooms River included traditional grazing lands of the Hessequa and Chainouqua Khoekhoen people (Clift, 2001) and that in particular, various kraals were scattered along the southern foothills of the Riviersonderend mountains during the early eighteenth century.

Cultivation:

Census records dating back to 1821 confirm that the farm Goereesoe was cultivated (wheat, barley, oats). These records also indicate that there was a communal bailing area northeast of Goreesoe (on the neighbouring farm Klaaskaffirsheuvel, now Muurkraal). While livestock was kept (cattle, horses, sheep and goats), the numbers kept were not considerable and appear to be more for domestic use than commercial production.

Water scarcity:

Water resources were clearly always limited within the general farming community within the environs as described through one of the conditions applied on a 1837 Quitrent Title for the farm Muurkraal with reference to water rights/ usage: “By mutual consent of the applicants, the pools at the upper end of the Botha’s ravine marked 1,2 and 3 although separately measured and included in the different portions of the respective parties, are to be used by them in community as long as the Water lasts”.

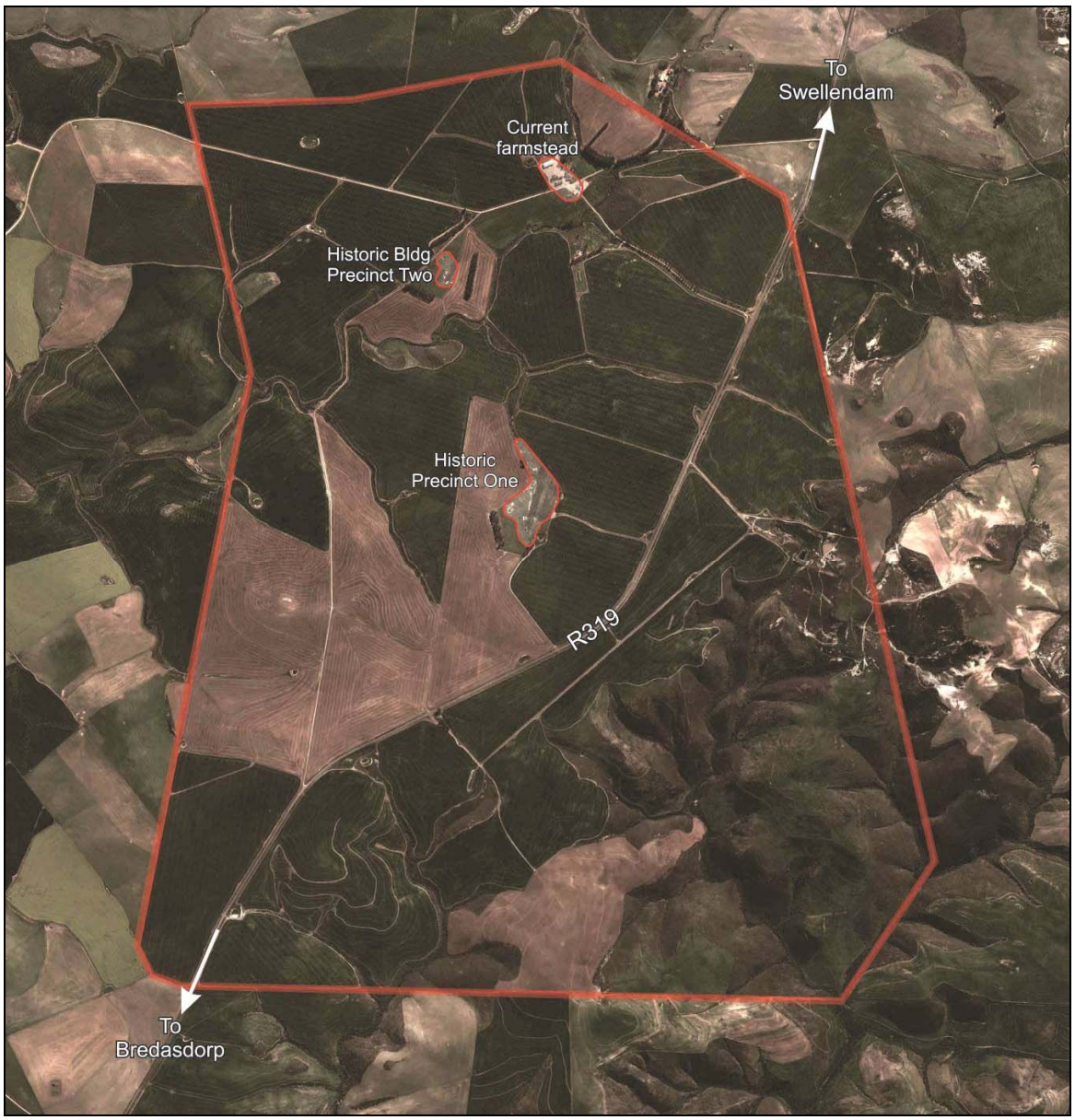

Figure 8.19: *Study area imposed on recent aerial image of surrounding areas*

Slavery:

Another important historic theme is slavery. Joint owners, de Swart and de Wet families owned slaves according the 1821 census and slaves were presumably employed with caring for livestock, domestic help and other farm duties. Hottentot workers were also listed as present on the farm on the 1821 census.

» **Assessment of the Built environment:**

From Surveyor General diagrams it would appear that an historic road from Swellendam traversed the property east to west and north of the ravine. The first diagram dated 1836 shows three dwelling houses along the historic road on the northern side of the ravine as well as a hut, north east of the homesteads. The location of these three homesteads appears to correlate with the location of the current 'modern' farmstead used by the land owner. The remains of the hut

were not located during field work investigation. No buildings were found on diagrams for the remaining portions, but this does not mean that buildings did not exist.

From the above it is therefore evident that the farm Goereesoe and environs have significant historic associations with agriculture, cultivation and the slave trade.

Built environment

A number of historic buildings and structures older than 60 years, arranged in four clusters within the study area, were recorded during fieldwork and are listed in the table 8.6 below (also refer Integrated heritage resource mapping). These clusters can be described as:

» The current (modern) farmstead with one remaining historic outbuilding;
» Labourer's cottage (abandoned) set within cluster of more recent cottages;
» Historic building precinct One including the ruins of at least six historic structures sited within the proximity of what had once been a significant farmstead;
» Historic building precinct Two including the ruins of at least seven historic structures located around what would have once been another significant farmstead.

Table 8.6: List of historic structures and landscape features older than 60 years recorded during fieldwork

Bldg Precinct	GPS #	Description of Heritage Resource
	71	Linear-planted gum trees perpendicular to R319
Building Precinct One	**72**	Copse of blue gum trees/ wind break
	73	Remains old water trough
	74	Old livestock keep, low, flat roof with corrugated iron roof sheeting and water reservoir to side.
	75	Ruin of two-roomed outbuilding, pit latrine (mud brick walls, corrugated iron flat roof)
	76	Ruin of substantial U-shaped, single-storey farmstead with stoep to front, two entrances to attic along front facade, later additions to side and rear. Mud brick construction with pitched (corrugated iron) roofing. Former sash windows, timber flooring and timber ceilings sadly removed and building allowed to deteriorate significantly – repair probably no longer feasible. Interior of building was not accessible due to presence of bee colony.
	77	Agricultural outbuilding with pitched roof and flat-roofed addition to side as well as an attic space. Mud brick construction and corrugated iron roofing with modern extensions to rear. North-facing gable replaced, building in neglected state. Interior not accessible due to presence of bee colony. Two circular modern silo structures to side.
	78	Agricultural outbuilding with pitched roof and flat-roofed extensions to side. More recent but >60 yrs with corrugated iron roofing. North-facing gable replaced in same style and (most likely) during same period as for #77 above.

Bldg Precinct	GPS #	Description of Heritage Resource
	78 a	Copse of blue gum trees
	78 b	Copse of blue gum trees
	79	Derelict labourer's cottage (mud brick)
	80	Former labourer's cottage set within copse of bluegum trees some distance north of main farmstead. Mud brick construction with corrugated iron roofing and attic. Interior not accessible due to presence of bee colony. Building allowed to deteriorate and in poor state.
	80 a	Row of blue gum trees lining approach road from R319
	80 b	Linear-planted blue gum trees (Y-shaped wind breaks)
	81	Agricultural store with kraal directly south. Mud brick construction, corrugate iron roofing, reed ceiling, still in use though in poor condition requiring urgent maintenance.
	82	Labourer's cottage older than 60 years in picturesque setting along slope and amongst row of bluegums and small dam. Pitched roof with attic and corrugated iron roofing and lean-to addition – also of corrugated iron sheeting. Small addition (bathroom) to side and previously fitted with water, electricity though now abandoned. In fair condition though requiring urgent maintenance.
Building Precinct Two	83	Building rubble dumped on top of foundations. Location corresponds with that of former structure visible on 1942 aerial photography.
	84	Small ruined outbuilding set within copse of bluegum trees (mud brick construction, square with simple but quaint northeast-facing gable)
	85	Ruin of substantial single-storey farmstead. U-shaped but with centrally-orientated flank to rear. Stoep to front (east-facing) elevation as well as two stoeps to rear elevation. Two entrances to attic along front facade. Mud brick construction with pitched (corrugated iron) roofing. Former sash windows, timber flooring and timber ceilings sadly removed and building allowed to deteriorate significantly – restoration probably no longer feasible. Interior of building not accessible due to presence of bee colony.
	86	Derelict secondary homestead of simpler but similar mud-brick construction as #85. Corrugated iron roofing and attic. Poor condition though presently used as storage.
	87	Two ruined agricultural outbuildings (mud brick construction, corrugated iron roofing) set to side of stonewalled kraal. Restoration probably no longer feasible.
	88	Linear-planted blue gum trees (wind break)
	89	Linear-planted blue gum trees (wind break)
	90	Linear-planted blue gum trees (wind break)
	91	Linear-planted blue gum trees (wind break)
	92	Rubbish dump
	93	Linear-planted blue gum trees (landscape framing/ wind break)

Figure 8. 20: Mapping of heritage resources in Historic Bldg Precinct One (Source: GoogleEarth)

Figure 8.21: Mapping of heritage resources in Historic Bldg Precinct Two (Source: GoogleEarth)

Most of the historic structures noted in the table above would appear to date to roughly the same period (estimate late eighteenth century) though some were clearly altered or added at a later stage. Details concerning former occupation or reasons for abandoning these historic structures could not be found. The high concentration and generally dilapidated condition of historic structures noted within the study area were disconcerting. Although early (1880-1890) mapping shows the locations of three "Houses" and a "Hut", it was unfortunately not possible to reconcile this with what remains in present day.

While unfortunately mostly ruined, the former historic farmsteads, outbuildings, labourer's cottages and associated structures recorded within the study area are strongly associated with agriculture and therefore considered to be of low local historic and architectural cultural significance. The clustering, siting and orientation of these historic buildings within the landscape, taking cognisance of micro-climatic conditions and providing for linear-planting of blue gum trees serving as effective windbreaks are considered of moderate to high local historic and aesthetic cultural significance.

Impact Tables – Impact of Construction on heritage resources

Nature: Disturbance and destruction of pre-colonial archaeological material by turbine footings, sub-stations, access roads and power lines No Early or Middle Stone Age implements or Historical archaeological material was recorded during the survey by the archaeologist. Two Later Stone Age sites were identified. They are Site 001-005 (a single site) and Site 006. It is concluded that the position of Turbine 6 will result in the destruction of Site 001-005. This Later Stone Age (LSA) site with silcrete adzes is unusual and has been allocated a medium to high significance because of the potential information it may provide of the late Wilton period in the Southern Cape. The access road to Turbines 8, 9 and 10 passes within 10m of Site 006. As an isolated occurrence it is considered of low significance, but together with Site 001-005 may inform on LSA settlement patterns in the area.		
	Without Mitigation	With Mitigation
Extent	Regional (3)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (5)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium < 52**	**Low < 30**
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	Yes (Site 001-005) at Turbine 6.	No
Can impacts be mitigated?	Yes	
Mitigation: » There are two alternatives to conserving the archaeological sites recorded during the		

survey. Turbine 6 may be moved further into the field and away from the koppie. This will ensure the site is not impacted at all. Alternatively, the site is sampled by an archaeologist/s with a permit issued by Heritage Western Cape. » With regard Site 006, it will not be possible to move the access road as it is located on a steeply sloping hillside. Mitigation in the form of archaeological sampling is the only alternative.
Cumulative impacts: The cumulative impact is not likely to differ from the above.
Residual impacts: None

8.9.1. Comparative Assessment of Substation and Power Line Alternatives

There will be no differences in the significance of heritage impacts for any of the alternative substation sites and power line routings. Therefore any of the proposed alternatives are considered acceptable from a heritage impact perspective.

8.9.2. Cumulative impacts

From a regional landscape perspective, the study area forms part of a rural landscape well south of Swellendam though not visible from this town or the N2 National Road. Development of a wind farm on the study site would have an impact on the rural landscape character of the site and its environs. However, in addition to the anticipated visual impact of the approved Innowind and BioTherm wind farms directly adjoining the site, approval of another wind farm is therefore likely have some cumulative impact. The risk of space crowding (high spatial density of impacts on a rural environment) of wind developments in the region does exists if they all reach an operational state.

he regional landscape character is considered to be of low local aesthetic cultural significance.

A moderate cumulative impact is expected, although there are large uncertainties involved in the cumulative impact assessment since the effect of large wind farms on the South African landscape is still unknown (Moderate impact).

8.9.3. Conclusions and Recommendations

» Turbine 6 will impact on LSA sites. This turbine position may be moved away from the koppie and further into the field in order to avoid these sites. The full extent of the archaeological site at this location needs to be determined and marked off, to ensure that it is not impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient but the full extent of the

site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape.

» Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required.
» If any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.
» If there are any significant changes to the layout of the Goereesoe Wind Farm as presented through the HIA (Appendix L), further archaeological survey work may be necessary.

8.10 Assessment of Potential Impacts on Palaeontology

The gently undulating landscape in the study area is largely underlain by Early to Middle Devonian sediments of the Bokkeveld Group (Ceres and Bidouw Subgroups). These marine to estuarine rocks were probably highly fossiliferous originally, containing rich assemblages of shelly invertebrates and trace fossils, as well as drifted land plant remains, fish and microfossils. However, on the southern coastal plain their fossil content has been largely destroyed by intense tectonic deformation during the Permo-Triassic Cape Orogeny (mountain-building event) as well as by deep chemical weathering beneath the so-called “African Surface” under humid tropical climates during the Late Cretaceous to Tertiary period. Exposure of these Palaeozoic rocks is very limited due to extensive cover by superficial sediments (mainly pedocrete lag gravels, soils, alluvium) that are themselves very poorly fossiliferous to unfossiliferous. A variety of Paleogene (Early Tertiary) to Quaternary duricrusts - tough, secondarily cemented superficial deposits (soils, gravels etc.), including silcretes and ferricretes of the Grahamstown Formation as well as younger calcretes - are present in the study area, but are also largely unfossiliferous. Recent palaeontological field studies in the region have failed to yield significant fossil remains, apart from sparse, low-diversity trace fossils.

8.10.1. Comparative Assessment of Substation and Power Line Alternatives

There will be no differences in the significance of fossil heritage impacts for any of the alternative substation sites and power line routings. Therefore any of the proposed alternatives are considered acceptable from a paleontological impact perspective.

8.10.2. Cumulative impacts

The cumulative impact on fossils from the Goereesoe wind energy facility and other projects in the area will not have a significant impact on palaeontological resources.

8.10.3. Conclusions and Recommendations

Due to the sedimentary rocks in the Goereesoe wind farm study area being either poorly fossiliferous, or their original fossil content has been largely destroyed by tectonic deformation and weathering, it is concluded that the proposed wind farm development will have a very low impact on the very limited local fossil heritage, whether during the construction phase or later. No further specialist studies or mitigation of palaeontological heritage for this project are recommended. However, should substantial fossil remains be exposed during development, the responsible ECO should alert Heritage Western Cape so that appropriate mitigation measures may be considered. Mitigation in the form of fossil recording and collection will have a positive impact on our appreciation of local fossil heritage.

8.11 Assessment of Potential Social and Economic Impacts

8.11.1. Key Issues associated with the Construction phase

The key social issues associated with the construction phase are the following:

Potential positive impacts:

» Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts:

» Impacts associated with the presence of construction workers on local communities;
» Impacts related to the potential influx of job-seekers;
» Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the INCA site;
» Increased risk of grass fires associated with construction related activities;
» Noise, dust and safety impacts of construction related activities and vehicles;
» Impact on productive farmland.

Both positive and negative social impacts are discussed below.

Impact Tables summarising social impacts during the Construction Phase

Nature: Creation of employment and business opportunities during the construction phase Based on the information from other WEFs the capital expenditure associated with the construction of a 30MW WEF would be in the region of R 400 million (2012 Rands). The

construction phase is expected to extend over a period of ~ 12 months and create approximately 60 construction related jobs. Of this total approximately 25 % (15) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 35 % (21) to semi-skilled personnel (drivers, equipment operators), and ~ 40% (24) to low skilled personnel (construction labourers, security staff). 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 line. Members from the local community are likely to be in a position to qualify for the majority of the low skilled and some of the semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in the surrounding area this will represent a social benefit. The remainder of the semi-skilled and majority of the skilled employment opportunities are likely to be associated with the contactors appointed to construct the WEF and associated infrastructure.

The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from Bredasdorp and Swellendam. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community. Implementation of the enhancement measures listed below can enhance these opportunities. This issue also highlights the importance of implementing a training and skills development programme before the construction phase commences.

The total wage bill with the construction of a 30MW WEF (60 employees X 12 months) is estimated to be in the region of R 10 million. This is based on the assumption that the average monthly salary for low, semi and skilled workers is R 5 000, R 12 000 and R 30 000 respectively. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in Bredasdorp and Swellendam.

In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and high import content associated with WEFs, the opportunities for the local economy and towns of Prieska, Upington, De Aar and Britstown are likely to be limited. However, opportunities are likely to exist for local contractors and engineering companies in Swellendam, Bredasdorp and Caledon. The implementation of the enhancement measures listed below can enhance these opportunities.

The sector of the local economy that is most likely to benefit from the proposed development is the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the construction workers on the site. The majority of construction workers are likely to be accommodated in Bredasdorp or Swellendam. This will create opportunities

for local hotels, B&Bs, guest farms and people who want to rent out their houses.

The hospitality industry in the local towns is also likely to benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other large construction projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

In terms of local support, Ms Venter (Swellendam Local Municipality IDP Manager) indicated that the Swellendam Local Municipality was aware of and supported the development of the proposed project. The IDP Manager also indicated that the proposed WEF had been approved by the Council and the project would be reflected in the revised IDP Report. The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors. The Swellendam Local Municipality highlights the importance of private sector investment the area. The proposed WEF also has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Swellendam Local Municipality.

	Without Mitigation	With Enhancement
Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	

Enhancement:

In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:

Employment

» Where reasonable and practical, INCA Energy should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» Where feasible, efforts should be made to employ local contactors that are compliant with Black Economic Empowerment (BEE) criteria;
» Before the construction phase commences INCA Energy should meet with representatives from the Swellendam Local Municipality to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures

that INCA Energy intends following for the construction phase of the project.

» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» INCA Energy should liaise with the Swellendam Local Municipality with regards the establishment of a database of local companies, specifically BEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» Where possible, INCA Energy should assist local BEE companies to complete and submit the required tender forms and associated information.
» The Swellendam Local Municipality, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.

Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

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

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

» An increase in alcohol and drug use;
» An increase in crime levels;
» An increase in teenage and unplanned pregnancies;
» An increase in prostitution;
» An increase in sexually transmitted diseases (STDs).

The potential risk to local residents in the area will be mitigated by the relatively small number of construction workers (60) and INCA Energy's commitment to implementing a local employment policy, specifically for the low and semi-skilled employment opportunities associated with the construction phase. The low and semi-skilled workers account for 45 of the 60 employment opportunities associated with the construction phase. The majority of these workers are likely to come from Bredasdorp and or Swelledam. Employing members

from the local community to fill the low-skilled job categories will reduce the risk and mitigate the potential impacts on the local communities. These workers will be from the local community and form part of the local family and social network and, as such, the potential impact will be low. The use of local residents to fill the low skilled job categories will also reduce the need to provide accommodation for construction workers. In this regard INCA Energy has indicated that no construction personnel will be accommodated on the site.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

	Without Mitigation	**With Mitigation**
Extent	Local (2) (Rated as 2 due to potential severity of impact on local communities)	Local (1) (Rated as 1 due to potential severity of impact on local communities)
Duration	Very short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc. (5)	Very short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for 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 for the community as a whole (21)** **Moderate-High for specific individuals who may be affected by STDs etc. (51)**	**Low for the community as a whole (18)** **Moderate-High for specific individuals who may be affected by STDs etc. (48)**
Status	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 farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

The potential risks associated with construction workers can be mitigated. The detailed mitigation measures should be outlined in the Environmental Management Programme (EMP) for the Construction Phase. Aspects that should be covered include:

» Where possible, INCA should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job

categories;

» INCA should consider the establishment of a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The Monitoring Forum should be established before the construction phase commences, and should include key stakeholders, including representatives from local communities, Swellendam Local Municipality Councillors, farmers and the contractor(s). The Monitoring Forum should also be briefed on the potential risks to the local community associated with construction workers;
» INCA and the contractor(s) should, in consultation with representatives from the Monitoring Forum, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation;
» INCA and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site over weekends or after hours;
» The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks;
» It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

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:

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.

Nature: Potential impacts on family structures, social networks and community services associated with the influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become “economically stranded” in the area or decide to stay on irrespective of finding a job or not. While the proposed INCA Swellendam WEF on its own does not constitute a large construction project, the proposed establishment of a two other WEFs in the area may attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social

impact. However, the manner in which they conduct themselves can impact on the local community.

The two main areas of concern are associated with the influx of job seekers:

» Impacts on existing social networks and community structures;
» Competition for housing, specifically low cost housing;
» Competition for scarce jobs;
» Increase in incidences of crime. The concern is that these job seekers may not leave town immediately and, in some cases, may stay indefinitely.

In some instances the potential impact on the community may be greater given that they are unlikely to have accommodation and may decide to stay on in the area. In addition, they will not have a reliable source of income. The risk of crime associated with the influx of job seekers it therefore likely to be greater.

Experience from other projects has also shown that the families of job seekers may also accompany individual job seekers or follow them at a later date. In many cases the families of the job seekers that become "economically stranded" and the construction workers that decided to stay in the area, subsequently moved to the area. The influx of job seekers to the area and their families can also place pressure on the existing services in the area, specifically low income housing. In addition to the pressure on local services the influx of construction workers and job seekers can also result in competition for scarce employment opportunities. Further secondary impacts included increase in crime levels, especially property crime, as a result of the increased number of unemployed people. These impacts can result in increased tensions and conflicts between local residents and job seekers from outside the area.

The findings of the SIA indicate that potential for economically motivated in-migration and subsequent labour stranding in Bredasdorp and Swellendam is likely to be low. The majority of job seekers are likely to come from towns within the Overberg District Municipal, such as Caledon, Suurbrak, Stuisbaai, Gaansbaai etc. Due to the proximity of these towns to the site and the strong links between local communities in the area the risk of labour stranding in Bredasdorp and Swellendam is likely to be low. The risks associated with the influx of job seekers are therefore likely to be low.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (24)
Status	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 farming	

	for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

It is impossible to stop people from coming to the area in search of a job. However, INCA Energy should ensure that the employment criteria favour local residents in the area. In addition INCA Energy should:

» As indicated above, INCA Energy, in consultation with the Swellendam Local Municipality, should investigate the option of establishing a Monitoring Forum to monitor and identify potential problems that may arise due to the influx of job seekers to the area. The Monitoring Forum should also include the other proponents of renewable energy projects in the area;
» INCA should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities;
» INCA should implement a policy that no employment will be available at the gate.

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:

» 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.

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

The presence on and movement of construction workers on and off the site poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Stock losses may also result from gates being left open and/or fences being damaged. Veld fires pose a potential risk to crops and pasture, while plastic waste may pose a risk to livestock if ingested. The proposed development will however only impact on one farm owner, namely Mrs Schoonwinkel. Based on other renewable energy projects, it is assumed that INCA have entered into an agreement with Mrs Schoonwinkel whereby compensation will be paid for damage to farm infrastructure etc.

None of local famers in the area who were interviewed (Mr Mostert, Mr Pratt, Mrs de Kock and Mr Swart) indicated that stock theft was a major concern. In addition, none of the adjacent farmers raised any major concerns regarding the presence of construction workers on the site.

	Without Mitigation	**With Mitigation**
Extent	Local (3)	Local (2)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation:

» INCA 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;

» INCA 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;

» INCA 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;

» The Environmental Management Plan (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 INCA 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 INCA must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;

» The housing of construction workers on the site should be strictly 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 grass fires that could in turn pose a threat to livestock, crops, wildlife and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. However, none of the local famers in the area who were interviewed (Mr Mostert, Mr Pratt, Mrs de Kock and Mr Swart) indicated that fire was a major concern.

» The potential risk of grass fires is heightened by the windy conditions in the area, specifically during the dry, windy summer months from November to March;
» The risk of fire related damage is exacerbated by the distance to fire-fighting vehicles which are located in the Bredasdorp and Swellendam.

	Without Mitigation	**With Mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Very short term (1)	Very short term (1)
Magnitude	Moderate due to reliance on agriculture for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (21)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» 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;
» Contractor to ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
» Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months;
» Contractor to provide adequate fire fighting equipment on-site;
» Contractor to provide fire-fighting training to selected construction staff;
» No construction staff, with the exception of security staff, to be accommodated on site over night;
» As per the conditions of the Code of 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

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 and local communities in the area. According to the developers, the route that will used to transport components to the site from Cape Town/Saldanha will be via the N7 to Moorreesburg, the R311 through the Riebeek Valley and then via R301 to Worcester and then the R60 to Swellendam and finally the R319 to the site. New internal access roads will be required to provide access to and between the turbines.

The transportation of components for WEFs involves large, abnormal loads. The timing of the trips will therefore need to be planned to minimize the potential impact on other road users. The contractor should be required to ensure that damage to local gravel roads are repaired before the handover of the project.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Very Short Term (1)	Very Short Term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

INCA Energy should enter into an agreement with the affected landowners whereby the company will compensate for damages to internal farm roads. In addition, the potential impacts associated with heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

» The transport of components that require large, abnormal loads should be timed to avoid the impact on other road users, specifically farmers during harvesting time and holiday makers. The trips should therefore be timed to avoid weekends, holiday periods and harvest time for farmers, specifically farmers located along the R311 through the Riebeek Valley, the R301 and the R60

» ;The contractor must ensure that damage to local gravel roads on the site and in the area are repaired before the completion of the construction phase. The costs associated

with the repair must be borne by the developer/contractor;

» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers;

» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts:

If damage to roads is not repaired then this will affect the farming activities in the area and 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:

If damage to roads is not repaired then this will affect the farming activities in the area and 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.

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 WEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The activities associated with the construction phase have the potential to result in the loss of land available for grazing and other agricultural activities. The site is has traditionally been used for cultivation of grain crops and grazing (sheep). The farm owner, Mrs Schoonwinkel, indicated that the impact of the proposed WEF on the economic potential of the farm would be limited. The potential losses will also be offset by the rental paid by INCA to Mrs Schoonwinkel.

In addition, the final disturbance footprint can also be reduced by careful site design and placement of components. 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. The normal farming activities can also continue once the wind turbines have been established. Recommended mitigation measures are outlined below.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated (5)	Short term if damaged areas are rehabilitated (1)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (27)**	**Low (16)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated

Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided

Mitigation:

The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include:

» The footprint associated with the construction related activities (access roads, 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 on the site, 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. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA (Savannah Environmental);
» The implementation of the Rehabilitation Programme should be monitored by the ECO.

Cumulative impacts:

Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated.

Residual impacts:

Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated.

8.11.2. Key Issues associated with the Operational phase

The following key social issues are of relevance to the operational phase:

Potential positive impacts

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust;
» The establishment of renewable energy infrastructure.

Potential negative impacts

» Influx of job seekers to the area;
» Loss of farm labour;
» Impact on productive farmland;
» The visual impacts and associated impact on sense of place;
» Potential impact on tourism.

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

Based on information from other WEF projects the proposed Goereesoe WEF will create ~ 10 employment opportunities for over a 20 year period. The total number of employment opportunities associated with the operational phase is therefore low. Of this total 8 are likely to be low and semi-skilled opportunities. These opportunities are likely to benefit HD members of the community. The skilled positions are likely to be filled by people from other parts of South Africa.

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 Swellendam Local Municipality IDP.

Given the location of the proposed facility the majority of permanent staff is likely to reside in the Bredasdorp and or Swellendam. In terms of accommodation options, a percentage of the non-local 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 monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20 year operational lifespan of the project.

The local hospitality industry in Bredasdorp and Swellendam 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.

	Without Mitigation	**With Enhancement**
Extent	Local and Regional (1)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:

The enhancement measures to enhance local employment and business opportunities during the construction phase (as discussed above), also apply to the operational phase. In addition:

» INCA Energy 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;

» INCA Energy, in consultation with the Swellendam Local Municipality, should investigate the options for the establishment of a Community Development Trust.
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: 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

Nature: Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy.

Community Trusts provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. This revenue can be used to fund development initiatives in the area and support the local community. The long term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed WEF plant can be used to support a number of social and economic initiatives in the area, including:

» Creation of jobs;
» Education;
» Support for and provision of basic services;
» School feeding schemes;
» Training and skills development;
» Support for SMME's.

In addition, the establishment of a WEF plant is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

Due the proposed establishment of a number of other renewable energy projects in the Swellendam Local Municipality and ODM as a whole, it is recommended that the Swellendam Local Municipality and ODM investigate the establishment of a single, renewable energy linked Development Trust whereby all potential renewable energy producers would contribute to the Trust. The motivation for the establishment of a larger, local municipality or district municipality trust would be to maximize the potential benefits to the broader region by creating a single fund that can be used to promote and support local, socio-economic development in the region as a whole.

The option of establishing a west coast district level fund should be investigated by the ODM in consultation with each of the local municipalities within the region.

	Without Mitigation	**With Enhancement[20]**
Extent	Local (2)	Local and Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (30)**	**High (70)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:

In order to maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented:

» Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community;
» Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF plant;
» The option of establishing a west coast district level fund should be investigated by the ODM in consultation with
» each of the local municipalities within the region

Cumulative impacts:

Promotion of social and economic development and improvement in the overall well-being of the community

Residual impacts:

Promotion of social and economic development and improvement in the overall well-being of the community

Nature: Promotion of clean, renewable energy

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. Much of the coal used has a high sulphur content. As a result South Africa is the nineteenth largest per capita producer of carbon emissions in the world, and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The overall contribution to South Africa's total energy requirements of the proposed WEF is

[20] Enhancement assumes effective management of the community trust

relatively small. However, the 30 MW produced will help to offset 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 an important contribution.

	Without Mitigation	**With Mitigation** (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	

Enhancement:

The establishment of the proposed facility is a mitigation measure in itself. In order to maximise the benefits of the proposed project INCA Energy should:

» Use the project to promote and increase the contribution of renewable energy to the national energy supply;
» Maximise the public's exposure to the project via an extensive communication and advertising programme;
» Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.

Cumulative impacts:

» Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

» Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Nature: Potential impacts on family structures, social networks and community services associated with the influx of job seekers

While the proposed INCA Swellendam WEF on its own is unlikely to result in an influx of job seekers during the operational phase, the proposed establishment of a number of other WEFs in the area may attract job seekers to the area. These issues are similar to the concerns associated with the influx of jobs seekers during the construction phase and include:

» Impacts on existing social networks and community structures;
» Competition for housing, specifically low cost housing;
» Pressure on local services, such as schools, clinics etc.;
» Competition for scarce jobs;
» Increase in incidences of crime.

However, as in the case of the construction phase, the findings of the SIA indicate that potential for economically motivated in-migration and subsequent labour stranding in the area during the operational phase is likely to be low. In addition, the employment opportunities associated with the operational phase of WEFs is limited. The risks associated with the influx of job seekers are therefore likely to be low.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	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 farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Enhancement:

The establishment of the proposed facility is a mitigation measure in itself. In order to maximise the benefits of the proposed project INCA Energy should:

» Use the project to promote and increase the contribution of renewable energy to the national energy supply;
» Maximise the public's exposure to the project via an extensive communication and advertising programme;
» Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.

Cumulative impacts:

» Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

» Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Nature: Potential impact on local farmers associated with loss of farm labour to the operational phase

Experience from other projects indicates that the loss of farm workers is an issue of concern. In most instances local farmers are unlikely to be in a position to compete with the salaries offered by the wind energy companies. As a result farm labourers may be tempted to resign from their current positions on farms. The loss of skilled and experienced farm labour would have a negative impact on local farmers.

While the proposed INCA Swellendam WEF on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of other renewable energy projects in the area and other parts of the Swellendam Local Municipality area has the potential to impact on the farming sector. However, at the end of the day farm labour can be replaced. The potential impacts on farm operations are therefore likely to be temporary.

The potential impacts for the affected farmers associated with the loss of permanent farm labour are exacerbated by the security of tenure that permanent farm labourers enjoy in terms of the Extension of Security and Tenure Act (ESTA). Those farm labourers which are eligible under ESTA and who take up jobs during the construction phase are entitled stay on in their houses on the farms in question. The net effect is that the farmer may have to incur the costs associated with the construction of new dwellings for new labour appointed to replace the labour lost to the wind energy sector.

However, at the same time the employment opportunities associated with the wind energy sector may offer local farm workers with an opportunity to get better paid jobs which would benefit them and their families. These jobs may also enable them to move off the farms and into local towns, which would improve their access to services such as schools and clinics etc. This would represent a positive social benefit for the farm workers in question. The findings of the Social Impact Assessment indicate that this positive impact would also be low.

	Without Mitigation	**With Mitigation**
Extent	Local and Regional (3)	Local and Regional (3)
Duration	Short term (2) (Assumed that farm labour can be replaced)	Short term (2) (Assumed that farm labour can be replaced)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (27)**
Status	Negative	Negative
Reversibility	Yes, if farm workers return or are replaced	Yes, if farm workers return or are replaced
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

» While INCA Energy could liaise with local farmers in the area and undertake not to

employ farm worker were possible, it is not possible to prevent farm workers from applying for work in other sectors. There are therefore no recommended mitigation measures. Also it is assumed that farm labour can be replaced. The impacts would therefore be temporary.
Cumulative impacts:
» Impacts on farm operations due to loss of experienced farm labour
Residual impacts:
» Impacts on farm operations due to loss of experienced farm labour

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

The components associated with the proposed facility will have a visual impact and, in so doing, impact on the landscape and rural sense of the place of the area. However, the proposed site is traversed by an Eskom power line. The visual integrity of the site has therefore to some extent been impacted by existing infrastructure on the site. In addition, the volume of traffic along the R 319 that is located adjacent to the site is relatively low. The wind turbines will also be visible from sections of the R 317, which is located to the west of the site.

None of local famers in the area who were interviewed (Mr Mostert, Mr Pratt, Mrs de Kock and Mr Swart) indicated that they were concerned about the potential impact of the proposed WEF on the visual quality of the landscape and the areas sense of place. A WEF is also proposed on Mr de Kock's farm, Remhoogte (Brakkefontein 6/51).

The findings of the Visual Impact Assessment (VIA) undertaken by MetroGIS are summarised below.

Potential visual impact on observers travelling along arterial and secondary roads in close proximity to the proposed wind farm

Potential visual impact on users of the R319 and secondary roads in close proximity of the proposed wind farm (i.e. within 8km) is expected to be of high significance. No mitigation is possible21.

Potential visual impact on residents of farmsteads in close proximity to the proposed wind farm

The potential visual impact on residents of farmsteads within an 8km radius of the proposed wind farm is expected to be of high significance. No mitigation is possible.

Potential visual impact on sensitive visual receptors within the region

The visual impact on the users of roads and the residents of settlements and homesteads within the region (i.e. beyond the 8km radius) is expected to be of moderate significance.

[21] It is possible to reduce the height or number of turbines, but as this constitutes a change in the structure and potential functionality of the proposed WEF, it is not entertained as a viable possibility for mitigation. In this respect, it is assumed that the proposed turbines have been selected / designed to optimise the wind resource.

No mitigation is possible.

Potential visual impacts on the visual character of the landscape and sense of place of the region

Specific aspects contributing to the sense of place of this region include picturesque and pastoral landscapes of the scenic Swellendam area. The combination of the widespread, fragmented viewshed and the low frequency of sensitive receptors within the viewshed leads the author to the conclusion that the construction of 13 turbines within this context is likely to result in a partial loss of / alteration to the characteristics of the baseline environment with the introduction of elements that are prominent and partially uncharacteristic when set within the attributes of the receiving landscape.

The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be of moderate significance. There is no mitigation for this impact.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (4)	Probable (4)
Significance	**Medium (32)**	**Medium (32)**
Status	Negative	Negative
Reversibility	Yes, wind facility can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	

Enhancement:

The recommendations contained in the VIA should be implemented. In addition, the 2011 Amended LUPO Regulations (mandatory) makes provision for various measures to address potential visual impacts, including siting, lay-out, height of ancillary structures, screening and lighting. The provisions are mandatory, and it is therefore assumed that these measures will be implemented.

Cumulative impacts:

Potential impact on current rural sense of place

Residual impacts:

Potential impact on current rural sense of place

Nature: Potential impact of the WEF on local tourism

The tourism sector is regarded as an important economic sector in the Swellendam Local Municipality and the ODM. The tourism potential of the area is linked to the areas natural resources, including the relatively undisturbed scenery, undulating wheat lands, coastal holiday settlements and rivers. However, as indicated above, the visual integrity of the site has to some extent been negatively impacted by the existing infrastructure that traverses

the site.

The tourist destinations in the area include the Cape Agulhas (the southern-most tip of Africa, the Agulhas National Park, the coastal towns of L'Agulhas and Struis Bay, Arniston and the De Hoop Nature Reserve. All of these destinations are located to the south and south west of the site. However, due the distances involved (between 50 km and 25km) and the natural topography, the wind turbines on the site will not be visible from any of these destinations. In terms of accessing these areas, the majority of visitors to the area access the area along the R 316, which links Bredasdorp with Caledon. The number of visitors accessing the area along the R 317 and R 319 is lower.

The impact of the proposed WEF on the tourism potential of the area and the Swellendam Local Municipality is therefore likely to be low. In this regard the Swellendam Local Municipality IDP Manager, Ms Venter, did not raise tourism as a concern. In some instances the plant may also attract tourists to the area. However, the significance of this potential benefit is also rated as low positive.

The findings of the VIA (MetroGIS) indicate that the anticipated visual impact of the facility on existing tourist routes and destinations is expected to be of low significance. There is no mitigation for this impact.

	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24) (Applies to both – and +)**	**Low (27) (Applies to both – and +)**
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:
The recommendations contained in the VIA should be implemented. In addition, the 2011 Amended LUPO Regulations (mandatory) makes provision for various measures to address potential visual impacts, including siting, lay-out, height of ancillary structures, screening and lighting. The provisions are mandatory, and it is therefore assumed that these measures will be implemented.

Cumulative impacts:
The proposed WEF is one of two WEFs proposed in the Swellendam Local Municipality area.

Residual impacts:

The proposed WEF is one of two WEFs proposed in the Swellendam Local Municipality area.

8.11.3. Cumulative impacts

Nature: Visual impacts associated with the establishment of more than one WEF and the potential impact on the areas rural sense of place and character of the landscape.

The Australian Wind Farm Development Guidelines (Draft, July 2010) indicate that the cumulative impact of multiple wind farm facilities is likely to become an increasingly important issue for wind farm developments in Australia. This finding is also likely to apply to WEFs and is also likely to be the case in South Africa. The key concerns in terms of cumulative impacts are linked to visual impacts and the impact on rural, undeveloped landscapes.

The Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. These issues raised in these guidelines as to what defines a cumulative impact are also regarded as pertinent to wind facilities, specifically given that the key issue of concern is likely to relate to the impact on rural, undeveloped landscapes. The relevant issues raised in the by Scottish Natural Heritage include:

» Combined visibility (whether two or more wind farms will be visible from one location).
» Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
» The visual compatibility of different wind farms in the same vicinity.
» Perceived or actual change in land use across a character type or region.
» Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Research on wind farms undertaken by Warren and Birnie (2009) also highlights the visual and cumulative impacts on landscape character. 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.

However, as indicated above, the areas sense of place has been impacted by the existing power line that traverses the site. The visual integrity of the site has therefore been impacted by the existing energy related infrastructure in the area.

In terms of cumulative impacts, two other WEFs are located in the vicinity of the proposed Swellendam WEF site. The potential therefore exists for cumulative impacts associated with Combined Visibility (two or more wind farms will be visible from one location) and Sequential Visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). Based on the findings of the VIA the significance of the impact is rated as Moderate Negative.

With regard to the area, a number of WEFs have been proposed in the Swellendam Local Municipality and ODM. The Western Cape Environmental Authorities should therefore be aware of the potential cumulative impacts when evaluating applications.

	Without Mitigation	**With Mitigation**
Extent	Local and regional (2)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (4)	Moderate (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
Status	Negative	Negative
Reversibility	Yes. Wind energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	

Enhancement:

The establishment of a number of large wind facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of such plants in an area. The applicable provisions of the 2011 Amended LUPO Regulations are mandatory, and should also be implemented.

Cumulative impacts:

Impact on other activities whose existence is linked to linked to rural sense of place and character of the area, such as tourism, bird watching, and hunting.

Residual impacts:

Impact on other activities whose existence is linked to linked to rural sense of place and character of the area, such as tourism, bird watching, and hunting.

Nature: The establishment of a number of renewable energy facilities within the Swellendam Local Municipality and ODM will create employment, skills development and training opportunities, creation of downstream business opportunities.

In addition to the potential negative impacts, the proposed INCA Swellendam WEF also has the potential to result in significant positive cumulative impacts, specifically the establishment of a number of other renewable energy facilities in Swellendam Local Municipality and ODM, will create a number of socio-economic opportunities for the Swellendam Local Municipality and ODM which, in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, creation of downstream business opportunities.

	Without Mitigation	**With Mitigation**
Extent	Local and regional (3)	Local and regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	**Medium (44)**	**High (70)**
Status	Positive	Positive
Reversibility	Yes. Wind energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	

Enhancement:
The proposed establishment of suitably sited renewable energy facilities within the Swellendam Local Municipality and ODM should be supported.

Cumulative impacts:
Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy

Residual impacts:
Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy

8.11.4. Comparative Assessment of Substation and Power Line Alternatives

Both substation site alternatives are expected to have similar impacts on the social environment. Both sites are considered acceptable. However, proposed substation alternative B location should be considered more favourable than alternative location A as it is closer to the power line grid connection and will contribute to significantly reduce the total length of any aerial overhead power line.

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

As indicated above, the visual character of the area has been negatively impacted by the existing power line. The social impacts associated with the proposed overhead power line will therefore be moderate to low.

The findings of the VIA (MetorGIS, 2012) indicate that the construction of the overhead power line could represent a visual impact. In addition to the power lines themselves, the alignment will require a cleared area at each pole footprint. This infrastructure is not likely to be as highly visible as the turbines, as the height of the structures will be much lower. The anticipated visual impact is likely to be of moderate significance both before and after mitigation.

	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	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Enhancement: See below		
Cumulative impacts: Limited visual and impact on sense of place		
Residual impacts: See cumulative impacts		

8.11.5. Conclusions and Recommendations

The findings of the SIA indicate that the development of the proposed INCA Swellendam WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the SIA should be implemented in order to maximise the potential benefits. In addition, the proposed establishment of a number of renewable energy facilities in the Swellendam Local Municipality and ODM will create socio-economic opportunities, which, in turn, will result in a positive social benefit. The significance of this impact is rated as High Positive.

Due the large number of renewable energy projects proposed in the Swellendam Local Municipality and the OCD as a whole, it is recommended that the Swellendam Local Municipality and OCD investigate the establishment of a Renewable Energy linked Development Trust whereby all potential renewable energy producers would

contribute to the Trust. The option of establishing a west coast district level development fund should be investigated by the OCD in consultation with each of the local municipalities within the region.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed INCA Swellendam WEF is therefore supported by the findings of the SIA.

However, the potential impacts associated with large, wind energy facilities on an area's sense of place and landscape cannot be ignored. These impacts are an issue that will need to be addressed by the relevant environmental authorities, specifically given the large number of applications for renewable facilities in the area.

8.12 The No Go Option

As indicated above, 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 producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. As discussed in Chapter 2, both national and the Western Cape provincial governments have set targets for renewables substitution.

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost.

In addition, the No-Development option would compromise the objectives of the WLM IDP and LED to create employment and support economic development.

However, at a provincial and national level, it should be noted that the Goereesoe wind energy facility is not unique. In that regard, a significant number of wind energy facility developments are currently proposed in the Western and Eastern Cape Provinces. Foregoing the proposed Goereesoe wind energy facility would therefore not necessarily compromise the development of renewable energy facilities in the Western Cape or South Africa. However, the benefits to the Swellendam Local Municipality and the Bredasdorp and or Swellendam communities would be lost should the facility not be developed.

The primary considerations pertaining to the do-nothing alternative relate to:

1. The current land-use regime of the site; and
2. The need to diversify the energy mix in South Africa.

These are discussed in further detail below.

1. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have moderate to high agricultural potential. The current land-use on the site is agriculture (mainly wheat and cereal production due to the winter rainfall). Summer land uses include extensive grazing of crop rests or fallows. The "do nothing" alternative would retain the current land-use (dryland agriculture: crop production - winter crops – grains and seed-oil), with losing out the opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that fall outside of the proposed wind energy facility infrastructure. The development of the wind energy facility would allow the on-going current crop production on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property. The do nothing alternative would result in a lost opportunity for the landowner (in terms of revenue) and the country (in terms of renewable energy).

2. 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 decision to expand South Africa's electricity generation capacity, and the mix of generation technologies is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Energy (DoE) and the National Energy Regulator of South Africa (NERSA). The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are taken into account.

   The generation of electricity from renewable energy in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in further by NERSA (March 2009), and include:

   » **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of

supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» **Resource saving:** Conventional coal fired plants are 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, where compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.

» **Exploitation of our significant renewable energy resource:** At present, valuable national resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.

» **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.

» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.

» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.

» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

» **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.

» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an

important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to final energy consumption by 2013. Furthermore the IRP 2010 states that 42% share of all new power generation should be derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010 – 2030). The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DoE's macroeconomic study on 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 (NERSA, March 2009).

The Climate Change Strategy and Action Plan for the Western Cape (2008) identified solar and wind energy as suitable renewable technologies for the Western Cape. The White Paper on Sustainable Energy for the Western Cape (2008) compliments the Climate Change Strategy and Action Plan, specifically by setting targets for renewable energy generation for the province. The Western Cape's target for electricity generated from renewable sources is that 15% of the electricity consumed in the Western Cape will come from renewable energy sources by 2014. Through research, the viability of the Goereesoe Wind Energy Facility has been established, and the developer proposes that up to 15 turbines (depending on the turbine selected) can be established as part of the facility. The 'do nothing' alternative will not assist the South African government in reaching the set targets for renewable energy. In addition the Western Cape's power supply will not be strengthened by the additional generated power being evacuated directly into the Provinces' electricity grid.

The 'do nothing' alternative is not a preferred alternative, as the result of not developing the wind energy facility will be that the following positive impacts will not be realised:

» Job creation from the construction and operational phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Utilisation of clean, renewable energy in an area where it is optimally available.

CONCLUSIONS AND RECOMMENDATION CHAPTER 9

IE Swellendam Wind (Pty) Ltd (a subsidiary of INCA Energy, herein after referred to as INCA Energy) is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Swellendam Local Municipality approximately 30 km south-west of Swellendam in the Western Cape Province. It is proposed for a cluster of up to 15 wind turbines (described as a wind energy facility or a wind farm), with a generating capacity of up to 45MW, to be constructed over an area of approximately 1 315 ha in extent. This facility is to be known as the **Goereesoe Wind Farm near Swellendam**.

The site for the proposed Goereesoe Wind Energy Facility falls within the Swellendam Local Municipality in the Western Cape Province. The broader area (1 315 ~ha in extent) includes Portions 0, 2, 4 and 5 of Farm 432 [22]Goereesoe (refer to Figure 1.1).

The project will include the following infrastructure:

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal/ access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (maximum of 100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which lies on the south western boundary of the site, and crosses the north western corner of the site. Two options are being considered and assessed in the EIA.
    - Option A, adjacent to the north of the proposed turbine 1 (Length of proposed power line: 1400.3m).

22 Note that Renosterhoek is the current name of the proposed farm. The 2011 cadastral dataset refer to the proposed farm names as Renosterhoek but the toposheets and titledeeds refers to the old name of Goereesoe from 1981.

- Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line (Length of proposed power line: 23.6m).

The environmental impact assessment (EIA) for the proposed Goereesoe Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 33306, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998) and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

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

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - O 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 and the associated infrastructure, including the substation and overhead power line. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. This layout includes 13 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Mitigation to avoid impacts are primarily associated with the relocation of certain turbine positions of concern as well as measures to be utilised during the construction phase to prevent negative

impacts from occurring. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMP)** included within **Appendix P**.

The client has revised the layout to avoid areas of high sensitivity (refer to figure 9.3). This revised layout has 14 proposed turbines.

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

9.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 13 turbines and associated infrastructure, Table 9.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 5, 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).

Table 9.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Flora		
Loss of Eastern Rûens Shale Renosterveld vegetation due to construction of wind turbines, transformers and construction of lay-down areas.	Low	Low
Loss of Eastern Rûens Shale Renosterveld vegetation due to construction and operation use of access roads, laying of underground cables and construction of overhead power line.	Low	Low
Loss of Rûens Silcrete Renosterveld vegetation due to construction of wind	High	n/a if mitigation implemented

Nature	Without mitigation	With mitigation
turbines, transformers and construction lay-down areas.		
Loss of Rûens Silcrete Renosterveld vegetation due to construction and operation use of access roads, laying of underground cables and construction of overhead power line.	High	n/a if mitigation implemented
Loss of ecological processes due to construction of wind turbines, transformers, construction lay-down areas and cable laying in Eastern Rûens Shale Renosterveld.	Low	Low
Loss of ecological processes due to construction of wind turbines, transformers, construction lay-down areas and cable laying in Rûens Silcrete Renosterveld.	High	n/a if mitigation implemented
Impacts on Fauna		
Habitat loss and degradation will have a negative effect on resident fauna.	High	Low
Roads, turbine lay-down areas and other transformed areas will reduce landscape connectivity and represent barriers to movement for some species.	Medium	Low
Fauna will be directly impacted by the development as a result of construction activities and human presence at the site during construction.	Medium	Low
Habitat loss and degradation will have a negative effect on resident fauna. In particular the presence of roads and other open areas and the noise generated by the turbines will constitute habitat degradation for many fauna.	Medium	Low
Roads, turbine lay-down areas and other transformed areas will reduce landscape connectivity and represent barriers to movement for some species. The noise generated by the turbines may also deter some fauna from the area.	Medium	Low
Fauna will be directly impacted by the development as a result of operation and maintenance activities.	Medium	Low
Habitat loss and degradation will have a negative effect on resident fauna. In	Medium	Low

Nature	Without mitigation	With mitigation
particular clearing activities and lack of follow-up revegetation may result in degradation as a result of alien plant invasion as well as erosion.		
If roads and other hard infrastructure are not removed during decommissioning they would contribute to reduced landscape connectivity.	Low	Low
Fauna will be directly impacted by the decommissioning as a result of the likely operation of heavy machinery on site as well as construction personnel.	Medium	Low
Impacts on Avifauna		
Destruction of agricultural land and grasslands due to the construction of platforms; workstation and substation; internal access roads; turbines, and the installation of underground cabling and overhead power lines	Medium	Medium
Disturbance of bird community and impact on Red Listed species due to the increase of people and vehicles in the area	Low	Low
Mortality of species, including priority species, due to turbines operation and collision with the rotating blades; collision and electrocution with overhead power lines	Medium	Low
Disturbance of bird community due to noise and movement generated by turbines operation and increase of people and vehicles in the area associated with maintenance activities.	Medium/Low	Low
Impacts on Bats		
Roost disturbance and/or destruction due to construction activities	Low	Low
Bat fatalities due to collision or barotrauma while foraging	(High	High
Disturbance to and displacement from foraging habitat due to wind turbine construction and operation	Medium	Medium
Bat fatalities due to collision or barotrauma during migration	High	Medium
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		

Nature	Without mitigation	With mitigation
Loss of agricultural potential and land capability	Medium	Low
Visual Impacts		
Potential visual impact on observers travelling along arterial and secondary roads in close proximity to the proposed wind farm	High	N/a
Potential visual impact on residents of farmsteads in close proximity to the proposed wind farm	High	N/a
Potential visual impact on sensitive visual receptors within the region.	Moderate	N/a
Potential visual impact of internal access roads on observers in close proximity to the proposed wind farm	Low	Low
Potential visual impact of the on-site ancillary buildings on observers in close proximity to the proposed wind farm	Low	Low
Potential visual impact on of lighting at night on visual receptors in close proximity to the proposed wind farm	Moderate	Moderate
Potential visual impact on of shadow flicker on visual receptors in close proximity to the proposed wind farm	Low	N/a
Potential visual impact of construction on visual receptors in close proximity to the proposed wind farm	Moderate	Low
Potential visual impact on the visual character of the landscape and sense of place of the region.	Moderate	N/a
Potential visual impact of the proposed facility on tourist access routes and tourist destinations within the region.	Low	N/a
Potential visual impact of the proposed facility on conservation areas within the region.	Low	N/a
Potential visual impact of the overhead power line on observers in close proximity thereto	Moderate	Moderate
Noise impacts		
Numerous simultaneous construction activities that could impact on receptors.	Low	n/a
Numerous turbines operating simultaneously during a period when a	Medium – for NSD03. Low – for all other	-

Nature	Without mitigation	With mitigation
quiet environment is desirable.	NSD's.	
Heritage Impacts		
Disturbance and destruction of pre-colonial archaeological material by turbine footings, sub-stations, access roads and power lines	Medium	Low
Impacts on Heritage Artefacts		
Impact of construction on archaeology	Medium	Low
Potential Impacts on Social Environment		
Creation of employment and business opportunities during the construction phase	Medium	Medium
Potential impacts on family structures and social networks associated with the presence of construction workers	Low for the community as a whole Moderate-High for specific individuals who may be affected by STDs etc.	Low for the community as a whole Moderate-High for specific individuals who may be affected by STDs etc.
Potential impacts on family structures, social networks and community services associated with the influx of job seekers	Low	Low
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Low	Low
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires	Medium	Low
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low	Low
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 WEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.	Low	Low
Creation of employment and business opportunities associated with the operational phase	Low	Low

Nature	Without mitigation	With mitigation
Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	Medium	High
Promotion of clean, renewable energy	Medium	Medium
Potential impacts on family structures, social networks and community services associated with the influx of job seekers	Low	Low
Potential impact on local farmers associated with loss of farm labour to the operational phase	Low	Low
Visual impact associated with the proposed wind facility and the potential impact on the areas rural sense of place.	Medium	Medium
Potential impact of the WEF on local tourism	Low (Applies to both – and +)	Low (Applies to both – and +)

9.1.2 Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat and impacts on soils. A wind energy facility is, however, dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 1 315ha was considered for the facility, of which ~0.5% will be utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed. The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Permanently affected areas comprise 13 turbine footprints (13 foundation areas of 20m x 20m), access roads (up to 5 m in width), one 132 kV substation footprint (maximum of 100m x 100m) and an operations and service building area (maximum of 100m x 100m). The area of permanent disturbance is approximated as follows:

Facility component - permanent	Approximate area/extent (in m^2)
13 turbine footprints (each 20m x 20m)	5200
Permanent access roads within the site (5 m width and 7973.03 m in length)	39865.15
One on-substation footprint (100m x 100m)	10000
Operations and service building area (100m x 100m)	10000
TOTAL	65065.15 m^2 (of a total area of 13150000m^2) **i.e. 0.5% of site**

It should be noted that the site currently has several existing access roads which are used for farming activities. The layout of the facility has, in agreement with the Department of Agriculture, utilised these existing roads in the facility layout to reduce the need for new roadways and thereby reduce impacts on current agricultural activities. It is planned that where existing access roads are able to be utilised within the development footprint, these are utilised, widened and upgraded where possible.

Approximately 0.5% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation of the Goereesoe Wind Energy Facility.

It should also be noted that the areas of permanent disturbance calculated above does not include the power line (which is a linear activity of up to ~1400.03 m for option A and ~23.6m in length for option B). Therefore the calculation above plus the power line will make up the total area of permanent disturbance.

Temporarily affected areas comprise 13 laydown areas for turbines (each laydown area assumed to have a footprint of 60m x 60m) and a temporary crane travel track and construction access roads utilising the same route as the permanent access road (an additional 6m in width to the permanent road of 5 m (i.e. taking the total roadway to be used during construction to 11m in width). The area of temporary disturbance is as follows:

Facility component - temporary	Approximate area/extent (in m^2)
13 turbine laydown areas (60m x 60m per turbine)	46800
Temporary crane travel track and construction access roads utilising the same route as the permanent access road (additional 3m in width) and 7973.03 m in length	23919.09

TOTAL	70719.09m^2 (of a total area of 13150000m2) = ~0.5% of site

Therefore, ~0.8% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Goereesoe Wind Energy Facility.

Considering permanent and temporary footprints, up to 1% of the total extent of 1315 ha will be disturbed by the construction and operation phases of the project.

9.2. Comparative Assessment of Grid Connection Alternatives (Substation & Power Line)

A power line will be required from the Goereesoe on-site substation to connect existing Vryheid-Bredasdorp 66kV power line.

Two on site substation positions and associated power line alignments/ alternatives are proposed in order to link the proposed facility to the Vryheid-Bredasdorp 66kV power line which lies on the south west boundary of the site, and crosses the north west corner of the site.

- Option A, adjacent to the north of the proposed turbine 1 (Length of proposed power line: 1400.3m).
- Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line (Length of proposed power line: 23.6m).

Both power line routes cross over the proposed site at different points and are expected to have similar impacts. Two alternative substation sites have also been assessed, i.e. Option A, adjacent to the north of the proposed turbine 1; Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line. These two routes and substation positions were considered and assessed in this EIA.

The impacts of the substation options and associated power line routes have been assessed in Chapter 8. In summary, the impacts of the power line include:

» Route B is shorter than Route A, i.e. substation Option B is located closer to the power line grid connection, which reduces the footprint of the power line.
» Substation B, along the south-western boundary of the site is considered the closest point of connection to the Eskom grid.
» Visual impacts will be reduced for Route B due to a shorter length of power line.

Therefore Substation site B and the associated power line Route B is the preferred option from an environmental perspective due to the reduced degree of disturbance compared to Route A.

9.3. [23]Cumulative Impacts

Based on the information available at the time of undertaking the EIA, four other wind energy facilities are planned on adjacent farm portions to the Goereesoe site (shown in **Figure 9.2**). These four facilities include the following:

Table 9.1: Table indicating other Wind Energy Facilities and distance from the proposed Goereesoe Wind Energy Facility

DEA ref	Project Title	Applicant	Location/Property	Capacity (MW)	EIA Status	Distance from proposed Development
12/12/20/1798	Proposed wind energy facility at Uitkyk/Excelsior near Swellendam	Biotherm Energy (Pty) Ltd	Farm Uitkyk RE/434; Farm Excelsior 432 portion 6; Farm Vryheid 435 portion 0; Farm Klaas Kaffer Heuwel 438 portion 1	143	EA issued October 2011	~5 km north east
12/12/20/1815	Proposed Innowind wind energy facility near Swellendam,	InnoWind (Pty) Ltd	Farms Vryheid and Kluitjieskraal) 34˚ 09' 34" S by 20˚ 18' 14" E)	30	EA issued November 2011	~15.5 km to the North East
12/12/20/1746	Klipheuwel/Dassiesfontein wind energy facility in the Overberg near Boontjieskraal	Biotherm Energy (Pty) Ltd	Farm Klipheuval 410 portion 8; Farm Alias Kruis Vley 410 portion 10; Farm Boontjieskraal 417 portion 0; Fram 418 remaining extent; Farm Kilp Heuvel 410 portion 5; Farm 410 remainning extent of portion 9; Farm Heuweltjieskraal portion of Pampoenkraal 843; Farm Dassiesfontein portion 1 remaining extent of Huveltjies Kraal 426	100	EA issued July 2011 (Preferred Bidder status received for 26 MW)	~ 76km to the west

[23] Cumulative Impacts derived from one particular project can be defined as "the impacts resulting from incremental actions or activities of the project in study with impacts resulting from other activities or projects from the past, present or reasonably predicted" (Hyder, 1999).

DEA ref	Project Title	Applicant	Location/Property	Capacity (MW)	EIA Status	Distance from proposed Development
12/12/20/2569	Proposed Denhami wind energy facility near Struisbaai	Denhami Research Farms CC	Farm Brak Fontein B284	20	Awaiting EA	~65km south south east

Cumulative impacts are summarised below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F – O and Chapter 8).

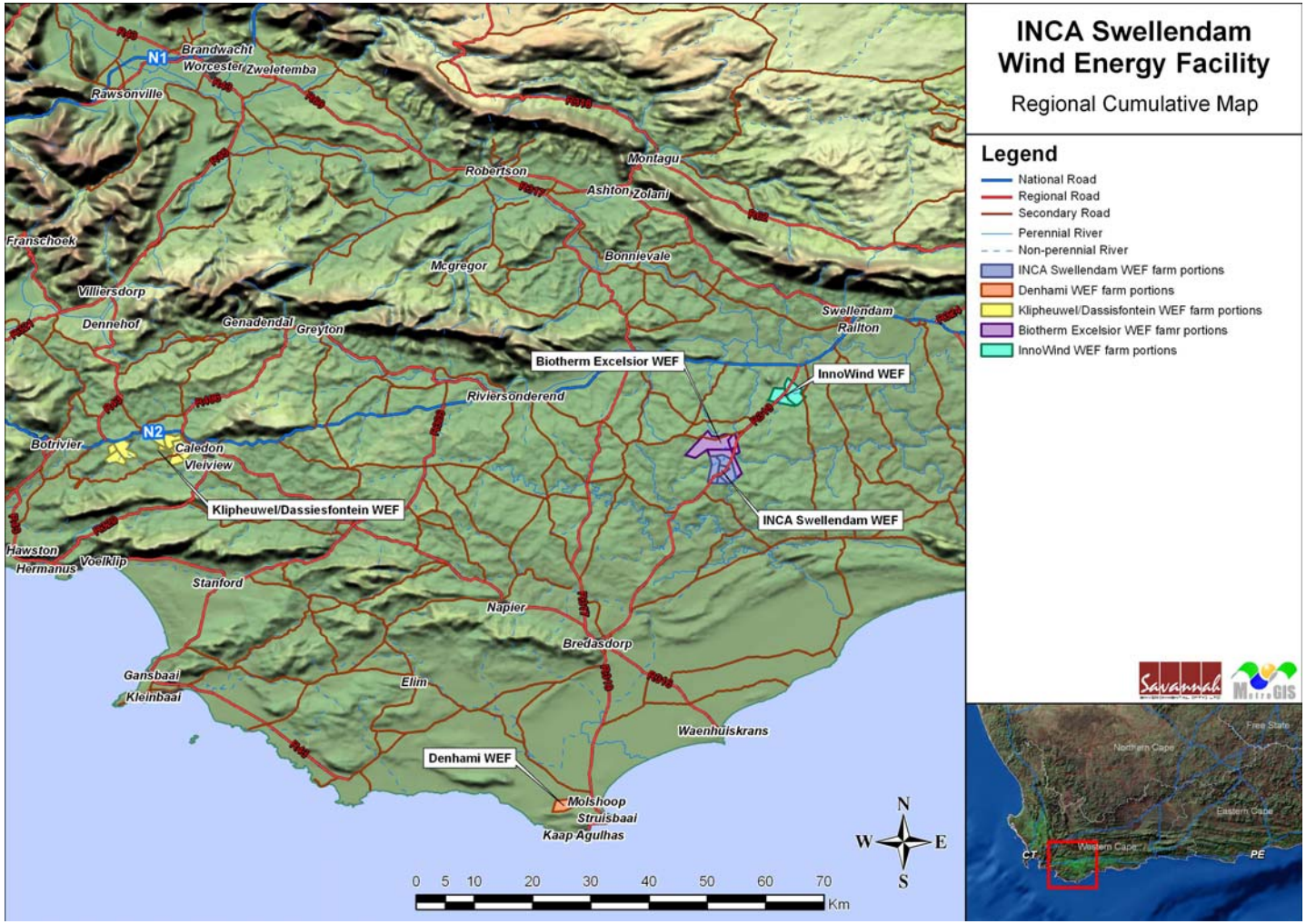

Figure 9.1: Map showing the location of the Goereesoe site and other wind energy facilities proposed in the area

The potential ***direct cumulative impacts*** as a result of the proposed project are expected to be associated predominantly with:

» *Visual impact* – The construction of 13 additional wind turbines and associated infrastructure will increase the cumulative visual impact of industrial and/or power related infrastructure (such as wind turbines, power lines and substations) within the region. This is especially relevant considering the possible future construction of the already authorised Excelsior WEF (up to 42 turbines) located immediately north of the wind farm. The cumulative impact of the Goereesoe wind farm is however expected to be mitigated in part, due to the comparatively limited number of turbines proposed to be constructed in comparison to the larger Excelsior WEF.

Therefore, in terms of cumulative impact, it is expected that the proposed Goereesoe facility will not result in an increased area of visual impact (i.e. beyond that of the authorised Excelsior WEF), but will result in an increase in the frequency of exposure within the existing viewshed. In this regard, visual receptors will be exposed to a greater number of turbines, which would imply a higher intensity of visual intrusion. However, additional visual sensitive receptors will not be impacted.

» *Social* (linked to visual) - The establishment of two or more wind energy facilities in the area will impact negatively on the landscape and the areas rural sense of place and character. The cumulative impact will, however, be of moderate significance due to the relatively low incidence of visual receptors in the region. On the other hand, cumulative positive socio-economic impacts from three or more wind energy facilities in terms of job creation and economic growth and development of infrastructure will occur in a local and district municipality that is in need of this growth and development, may be significant.

The potential ***indirect cumulative impacts*** as a result of the proposed project are expected to be associated predominantly with:

» *Flora* - The major cumulative impact would be the contribution to loss of Rûens Silcrete Renosterveld which harbours many endemic and threatened species. This would result from on-site construction activities as well as possibly from the construction of the power line across sensitive vegetation. Any loss of Rûens Silcrete Renosterveld or impact on this Critically Endangered vegetation type in any part of its range would have negative cumulative effects.

» *Fauna, and ecological processes* - The area is already severely impacted by transformation and additional impacts to intact vegetation would be highly

undesirable. Provided that the development can be restricted to transformed habitats, then the construction of the facility would contribute little to cumulative habitat loss and degradation in the area.

» *Avifauna* - It is already known that the BioTherm Swellendam wind energy facility is being planned in the vicinity of the proposed Goereesoe development. It is planned to be up to 143MW in capacity and is located on the farms Uitkyk RE/434; Excelsior 432 portion 6; Vryheid 435 portion 0; and Klaas Kaffer Heuwel 438 portion 1 to the north of the proposed Goereesoe wind energy facility site. This project is authorised by the DEA but is not yet a preferred bidder by the Department of Energy. Potential cumulative impacts may derive if the wind energy facility to the north is implemented but its significance will depend on the timing of the construction, with the significance of these cumulative impacts being higher if the construction of both developments occurs simultaneously and lower if development is not simultaneous, and lowest if these events occur after the regeneration / rehabilitation of the affected vegetation of the first facility constructed. The cumulative impacts associated with the construction phase are considered to be of very low significance. It is considered unlikely that the construction of all developments will occur simultaneously, and considering that the impacts during the construction phase are mainly related to habitat destruction and the expected limited extent of the affected areas, the cumulative impacts associated with the construction phase are considered to be of very low significance.

In the event of the two wind energy facilities becoming operational, cumulative impacts may be expected and higher mortality of bird species may occur. Due to the small size of Goereesoe wind energy facility (13 turbines) the potential cumulative impacts resulting from the interaction of both developments is considered to be of low significance. A bird monitoring program should be implemented during operation, and will allow determination of the actual cumulative impacts of the wind energy facility on the bird community.

» *Cumulative Impacts on Bats* - The impact of two or more developments of a similar nature in one area is likely to be more than twice the impact of two single developments. . Should the Uitkyk/Excelsior wind energy facility on the adjacent property be developed, this could cumulatively result in higher rates of bat mortality due to collision or barotrauma. To reduce the possibility of displacing bats from foraging areas in the area it would be better to place a second development in a different area.

» *Cumulative geology, soil and erosion potential* - Cumulative impacts can be considered possible due to the likelihood of other projects (renewable energy

or other) in the area that will also lead to loss of agricultural land. This cumulative impact is however considered to be of low significance and can be limited through the implementation of appropriate mitigation measures as agreed with Department of Agriculture. The footprints of such projects are small in relation to available land. Non-irrigated land is not a particularly limited resource in the area, and relatively small losses of no-irrigation land to agriculture will have very little impact on the total agriculture of the area.

» *Cumulative noise impacts* – The development of the Excelsior WEF to the north of the Goereesoe Wiind Farm may result in a slight cumulative noise impact at NSD03 and NSD06. The magnitude of this cumulative impact is estimated to be less than 1 dB due to the distance of these noise-sensitive developments from the closest wind turbines of the Excelsior WEF (more than 1,000 meters). This 1 dB increase will not change the magnitude of the impact nor the probability of the noise impact occurring and the significance of the noise impact will remain a low-medium.

Similarly, depending on the exact location of the closest wind turbines of the Excelsior WEF the potential noise impact at NSD01 and NSD08 may increase. The increase could range between 1 and 2 dB and could raise the magnitude of the noise impact to a low-medium from a low, and potentially increase the probability of the noise impact occurring from an unlikely to a possible. This however will not increase the significance of the noise impact from the current low (at NSD01 and NSD08).

» *Heritage and palaeontology* – From a regional landscape perspective, the study area forms part of a rural landscape well south of Swellendam though not visible from this town or the N2 National Road. Development of a wind farm on the study site would have an impact on the rural landscape character of the site and its environs. However, in addition to the anticipated visual impact of the approved Innowind and BioTherm wind farms directly adjoining the site, approval of another wind farm is therefore likely have some cumulative impact. The risk of space crowding (high spatial density of impacts on a rural environment) of wind developments in the region does exists if they all reach an operational state.

The regional landscape character is considered to be of low local aesthetic cultural significance. A moderate cumulative impact is expected, although there are large uncertainties involved in the cumulative impact assessment since the effect of large wind farms on the South African landscape is still unknown (Moderate impact).

The cumulative impact on fossils from the Goereesoe wind energy facility and other projects in the area will not have a significant impact on palaeontological resources.

» *Existing Infrastructure* - Increased pressure on existing roads and other infrastructure may occur.

The overall cumulative impact is considered insignificant and acceptable from an environmental point of view, due to the small nature of the proposed Goereesoe Wind Farm, i.e. a facility of up to 13 turbines. Due to the close proximity to the adjacent BioTherm Wind Farm, these two facilities could seem to form part of one bigger facility.

9.4. Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Goereesoe Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 9.2 and A3 map in Appendix Q**). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» Remnants of ***Eastern Rûens Shale Renosterveld*** (including the constituent plant species and the habitat created by the plant communities) ***and Rûens Silcrete Renosterveld:*** This vegetation occurs mainly on the south-eastern section of the site. These are Critically Endangered vegetation types and are considered to be no go areas for development. **Turbines 6 & 7** should be relocated to areas on the site where this important vegetation type is not found. Cables and roads should also avoid areas of Endangered Rûens Silcrete Renosterveld.
» ***Bats sensitive areas*** - At least one of the species identified as potentially occurring in the area of the study site is listed as Vulnerable (*Cleotis percivali)* and three as Near Threatened (*Eidolon helvum, Miniopterus natalensis* and *Rhinolophus swinnyi*). The proposed turbine placements must be critically revised with the key objectives of moving the Turbines located in area of High Bat Sensitivity (i.e. **turbines 1, 3 and 8**) to an alternative location outside of high sensitivity areas. Turbines located in the areas of Moderate Bat Sensitivity (i.e. turbines 11, 12 and 13) should preferably be moved to alternative locations. If this is not possible due to other constraints, these turbines must at least be prioritized in post-construction monitoring and implementation of mitigation measures.
» ***Heritage artefacts*** – Turbine 6 will impact on LSA sites. This turbine position may be moved away from the koppie and further into the field in order to avoid these sites. The full extent of the archaeological site at this location needs to be determined and marked off, to ensure that it is not

impacted during construction. Alternatively, the site may be sampled by an archaeologist. Since there is no evidence of any depth of deposit, surface collections may be sufficient but the full extent of the site needs to be determined, mapped and artefacts collected for analysis back in the laboratory. This will require a permit issued by Heritage Western Cape. Avoidance of Site 006 is not possible as the access road follows a steeply sided hill and mitigation will be required. No graves were observed in the study area, but if any unmarked graves or human remains are uncovered during the construction of the site, work should stop in that area and Heritage Western Cape must be notified.

» ***Noise sensitive developers*** do occur in and around the site. The relocation of **turbine 03** further away from receptor **NSD03** will reduce the noise impact significance from a ***medium*** to a ***low*** at this receptor. The developer has indicated that they may remove **turbine 02** rather than turbine 03 (second turbine in proximity to **NSD03**). This option will also reduce the significance of a noise impact to a ***low*** at the receptor. It is deemed sufficient to remove either turbine, and therefore no further investigations or calculations will be conducted.

Final turbine positioning and placement of associated infrastructure should take cognisance of sensitive areas (as indicated on Figure 9.2). Should mitigation measures in the EMP be adhered to, impacts on the identified sensitive areas can be adequately managed.

During operation of the facility, the threat of fatalities of avifauna and bats is also considered a potentially significant impact. The13 wind turbines are to be sited in already transformed agricultural land. They are at a reasonable distance from most tree and shrub habitats and therefore birds dependent on these habitats are unlikely to be impacted. The turbines are also to be sited more than 200 m from wetlands, which provide habitats for bird species. Birds in agricultural land already tolerate major seasonal changes in micro-habitat and periods of major human disturbance (ploughing, harvesting etc.) and therefore, for most species, displacement is unlikely to be severe. There is ample alternative habitat available so the loss caused by the footprint of the development is considered unimportant.

The key issue of concern is for birds being killed through collision with the turbines and the associated power line. Means of mitigating collisions are recommended by the avifauna specialist.

» A new power line will cross the proposed site from the proposed Goereesoe Substation. This line will form an obstruction to birds which use the site and its associated vegetation as a flight line. Collision with this line must be mitigated by installation of bird diverters where the line crosses the river.

» A bird pre-construction monitoring programme has been initiated by the developer, and the data collected through this programme has been provided for consideration in this assessment. This programme should be continued pre-construction in order to collect data within all seasons and inform the final layout of the facility.
» Some birds resident in the immediate area will most likely be killed through collision with turbines. Based on the results of the monitored data collected to date, as well as from further observations on the site, the number of birds expected to be killed annually is unlikely to be high and most of the species concerned are not of marked conservation concern. The identified species most likely to suffer the impacts caused by the presence of this infrastructure mostly include raptors and cranes (e.g. Yellow-billed Kite and Blue Crane).
» The developer will initiate the radar survey, and the data obtained will be available to the specialist for consideration and review of the final turbine layout pre-construction and submitted to DEA should this be required.

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

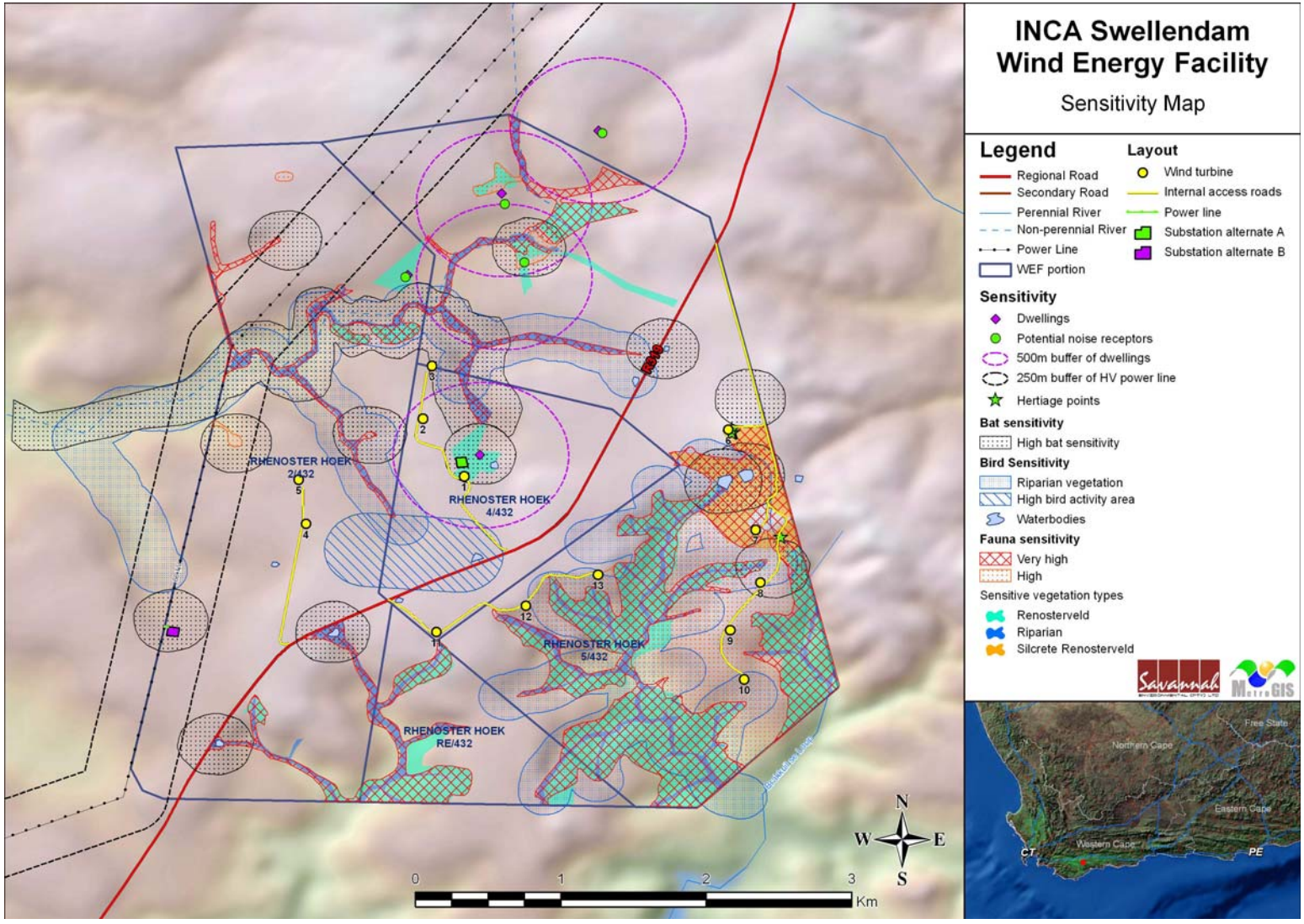

Figure 9.2: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Goereesoe wind energy facility **(Appendix Q contains A3 maps)**

9.5.1 Micro-siting of turbines

The only areas which can be considered as a 'no go' areas for the construction of infrastructure (including turbines) are:

» The south eastern portion of the site with the Remnants Eastern Rûens Shale Renosterveld and Rûens Silcrete Renosterveld.
» Drainage lines
» Areas of high bat sensitivity
» Area in close proximity to a noise sensitive development

In order to minimise potential impacts during construction and operation on these potentially sensitive areas within the site, the following recommendations have been made:

1. Turbines 6 and 7 and the associated road infrastructure should be shifted to locations outside of the Critically Endangered Rûens Silcrete Renosterveld.
2. Alternative access and cable routes to the proposed sites for Turbines 8 – 10 must be considered. It must be ensured that there is no impact on Rûens Silcrete Renosterveld.
3. The proposed turbine placements must be critically revised with the key objectives of moving the turbines located in area of High Bat Sensitivity, i.e. turbines 1, 3 and 8.
4. Turbines located in the areas of Moderate Bat Sensitivity (i.e. 11, 12 and 13) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritized in post-construction monitoring and implementation of mitigation.
5. The relocation of turbine 3 in close proximity to noise sensitive development should be considered to minimise the noise impact.
6. Turbine 6 may relocated away from the koppie and further into the field from a heritage perspective. Alternatively, the site may be sampled by an archaeologist following the obtaining of a permit to destroy the site.

Figure 9.3 provides a revised layout where the turbine placement has been shifted to areas of lower sensitivity through a micro-siting exercise to avoid these areas of environmental sensitivity identified during this environmental assessment. This revision of the layout has considered this assessment as well as technical aspects of the project.

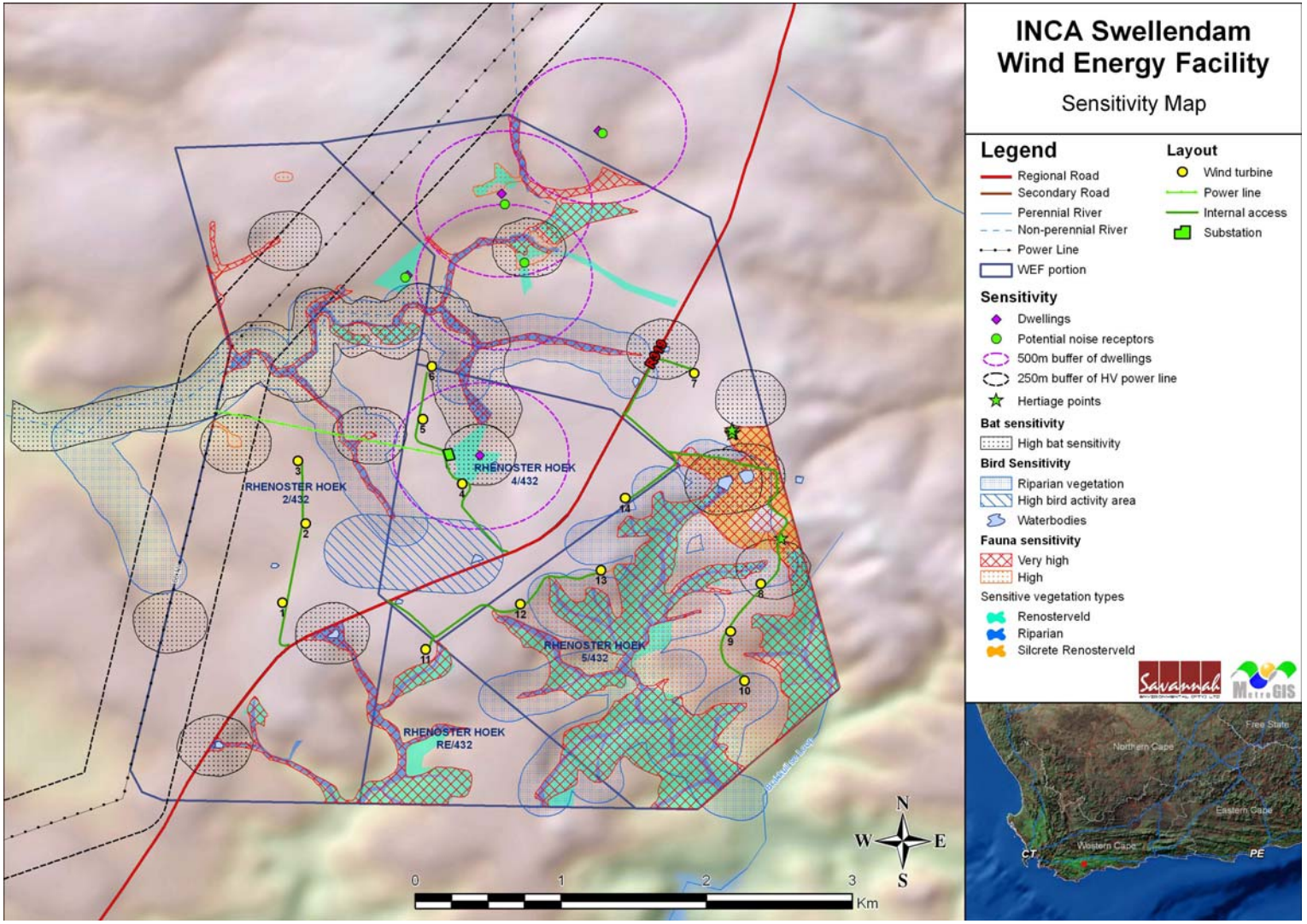

Figure 9.3: Map indicating revised layout to avoid placement of turbines and infrastructure in areas of high sensitivity

In terms of this revised layout, the following changes have been made:

7. Turbines 6 and 7 and the associated road infrastructure should be shifted to locations outside of the Critically Endangered Rûens Silcrete Renosterveld. **Turbine 6 and 7 have been relocated outside of no-go areas.**
8. Alternative access and cable routes to the proposed sites for Turbines 8 – 10 must be considered. It must be ensured that there is no impact on Rûens Silcrete Renosterveld. **Existing roads in this area will be utilised. These roads will be improved for construction.**
9. The proposed turbine placements must be critically revised with the key objectives of moving the turbines located in area of High Bat Sensitivity, i.e. turbines 1, 3 and 8. **The developer has agreed to move these turbines should this be required, based on the outcome of the 12 Month bat monitoring.**
10. Turbines located in the areas of Moderate Bat Sensitivity (i.e. 11, 12 and 13) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritized in post-construction monitoring and implementation of mitigation. These turbines will be prioritised in the monitoring programme as recommended.
11. The relocation of turbine 3 in close proximity to noise sensitive development should be considered to minimise the noise impact. **This turbine is located outside the 500 m buffer area and is considered possible to implement operation mitigation to minimise noise impacts.**
12. Turbine 6 may relocated away from the koppie and further into the field from a heritage perspective. Alternatively, the site may be sampled by an archaeologist following the obtaining of a permit to destroy the site. **Turbine 6 has been relocated.**

9.5. 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. In order to meet the long-term goal of a sustainable renewable energy industry in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation capacity being derived from renewable energy forms by 2030.

Through pre-feasibility assessments and research, the viability of establishing the Goereesoe Wind Energy Facility in the Western Cape has been established by IE

Swellendam Wind. The positive implications of establishing the Goereesoe wind energy facility on the demarcated site include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The National electricity grid in the Western Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» 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, monitoring and management measures are implemented.
» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

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

9.6. 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 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 Goereesoe wind energy facility and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

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

» The site is proposed to accommodate up to 15 wind turbines over an area of approximately 1 315 ha. The facility would be operated as a commercial wind energy facility with each turbine being up to 3MW in capacity. The capacity of the facility will be up to 45MW.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel/concrete tower, a hub (up to 110m hub height, depending on the turbine size selected) and three blades (up to 112m rotor diameter).
» Internal/ access roads (up to 5 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (maximum of 100 m x 100 m) to facilitate grid connection. Two alternative positions are proposed for this substation and are being assessed in the EIA.
» An overhead power line (66kV) likely to be connected to the existing Vryheid-Bredasdorp 66kV power line which lies on the south western boundary of the site, and crosses the north western corner of the site . Two options are being considered and assessed in the EIA.
    - Option A, adjacent to the north of the proposed turbine 1 (Length: 1400.3 m)
    - Option B, located on the south-western boundary of the proposed project site adjacent to the existing Vryheid-Bredasdorp 66kV power line (Length:23.6 m). Route B is nominated as the preferred option from an environmental perspective.

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

» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to O must be implemented.
» The draft Environmental Management Programme (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.
» 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 comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants,

this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species. Should TOPS species be identified during the final ecological survey, in terms of the NEM:BA a permit (a TOPS permit) will be required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Nature and Environmental Conservation Ordinance of 1974 and the Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000).

» Avoid the no go areas and consider relocation of turbines 1; 3; 8 based on the outcome of the bird and bat monitoring currently underway on site.
» Make use of existing roads as far as possible.
» The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMP to be compiled for the project.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» The pre-construction bird and bat monitoring programmes that have been initiated and are underway on the site should continue in order to inform the final micro-siting of the wind turbines. Pre-construction bird and bat monitoring should continue to establish an adequate baseline for comparative purposes, in line with the latest version of the South African best practice bird and bat monitoring guidelines.
» Bird diverters must be utilised on the new power line
» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
» Adequate stormwater management measures to be put in place.
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the

procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMP).

» Quarterly noise measurements are recommended for the first year of operation of the wind energy facility.

» Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

REFERENCES CHAPTER 10

8.1. Arangie, P and Krogscheepers C., 2012. **Error! Use the Home tab to apply Study to the text that you want to appear here.**: **Error! Use the Home tab to apply ReportTitle to the text that you want to appear here. Error! Use the Home tab to apply Location to the text that you want to appear here.**

8.2. Barbour, T. 2012. Social Impact Assessment (Draft Report) Inca Swellendam Wind Energy Facility Swellendam, Western Cape Province

8.3. De Jager, M., 2012. IE Swellendam Wind (Pty) Ltd Environmental Noise Impact Assessment Establishment of the Swellendam Wind Energy Facility on the Farm 432 Goereesoe near the town of Swellendam, Western Cape Province

8.4. De Kock, S. 2012. Integrated Heritage Impact Assessment in Terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 Of 1999) -Proposed Goereesoe Wind Energy Facility: Portions of the Farms Goereesoe 432/ Rem, 2, 4 & 5, Swellendam District

8.5. Du Plessis, L., 2012. Proposed Goereesoe Wind Farm in the Western Cape Province Visual Impact Assessment

8.6. Lanz J., 2013. Agricultural Impact Table

8.7. McDonald, D. 2012. Botanical Impact Assessment for a proposed wind energy facility at Goereesoe Farm near Swellendam, Overberg, Western Cape

8.8. Monteir, B and Ramahlo, R Goereesoe. 2012. Wind Energy Facility – Avifaunal Impact Study

8.9. Potgieter, K. 2012. IE Swellendam Wind (Pty) Ltd (a subsidiary of INCA Energy) Bat Impact Assessment for the Proposed Goereesoe Wind Farm near Swellendam Western Cape Province

8.10. Todd, S,. 2012. Proposed IE Swellendam Wind Energy Facility: Fauna Specialist Report for Impact Assessment