ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT EIA REPORT

PROPOSED GAROB WIND ENERGY FACILITY PROJECT, LOCATED NEAR COPPERTON IN THE NORTHERN CAPE PROVINCE

NORTHERN CAPE PROVINCE
(DEA Ref: 14/12/16/3/3/2/279)

DRAFT FOR PUBLIC REVIEW

09 November 2012 to 10 December 2012

Prepared for:

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/279
Title	:	Environmental Impact Assessment Process Draft Environmental Impact Assessment Report: Garob Wind Energy Facility Project, located near Copperton in the Northern Cape Province
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Project Developer	:	Garob Wind Farm (Pty) Limited (a juwi Renewable Energies (Pty) Ltd initiative)
Report Status	:	Draft Environmental Impact Assessment Report for public review
Review Period	:	09 November 2012 to 10 December 2012

When used as a reference this report should be cited as: Savannah Environmental (2012) Draft Environmental Impact Assessment Report: Garob Wind Energy Facility Project, located near Copperton in the Northern Cape Province

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Garob Wind Farm (Pty) Ltd is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site near Copperton in the Northern Cape Province. Garob Wind Farm (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 nine sections:

» **Chapter 1** provides background to the proposed Garob Wind Farm and the environmental impact assessment.
» **Chapter 2** describes the strategic context for energy planning
» **Chapter 3** describes wind energy as a power option and provides insight to technologies for wind turbines.
» **Chapter 4** outlines the process which was followed during the EIA Phase of the EIA process, including the consultation programme that was undertaken and input received from interested parties.
» **Chapter 5** describes the scope of the proposed project
» **Chapter 6** describes the existing biophysical and socio-economic environment that may be affected by the proposed development.
» **Chapter 7** describes the assessment of environmental impacts associated with the proposed Garob Wind Farm.
» **Chapter 8** describes the assessment of environmental impacts associated with the proposed Garob power line.
» **Chapter 9** presents the conclusions of the impact assessment as well as impact statement for the Garob Wind Farm and associated power line.
» **Chapter 10** provides references used to compile the EIA Report.

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

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all

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

INVITATION TO COMMENT ON THE 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 **09 November 2012 to 10 December 2012.**

» www.savannahsa.com
» Siyathemba Public Library
» Alpha Library
» Alkantpan Lodge

Please submit your comments to
Gabriele Wood of Savannah Environmental PO Box 148, Sunninghill, 2157 Tel: 011 234 6621 Fax: 086 684 0547 E-mail: gabriele@savannahsa.com
The due date for comments on the Draft EIA Report is **10 December 2012**

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

SUMMARY

Garob Wind Farm (Pty) Limited is proposing the establishment of a commercial wind energy facility and associated infrastructure on an identified site located near Copperton in the Northern Cape Province of South Africa. The proposed site is located within the Siyathemba Local Municipality (within the Pixley ka Seme District Municipality), approximately 10 km east of the town of Copperton, and ~35 km south west of the town of Prieska. This proposed project will be referred to as the **Garob Wind Farm**.

Infrastructure associated with the **Garob Wind Energy Facility** will include:

- 58 **wind turbines** with a hub height of up to 100m and a rotor diameter of up to 120m. The facility will have a total generation capacity of up to 140 MW.
- Concrete **foundations** to support the turbines.
- **Cabling** between the turbines, to be laid underground where practical so to connect to the on-site substation.
- Internal **access roads** to each turbine (approximately 7 m wide) linking the wind turbines and other infrastructure on the site. Existing roads will be used where possible.
- An on-site substation to facilitate the connection between the wind energy facility and the electricity grid.
- New 132 kV overhead power line. Two options are being considered as follows (see also Figure 1 below) :
  - Option 1: Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
  - Option 2: would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
    - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
    - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project

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

NEMA is the national legislation that provides for the authorisation of "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as the commenting authority. An application for authorisation has been accepted by DEA under application reference number 14/12/16/3/3/2/279.

The construction of the Garob Wind Farm will lead to permanent disturbance of an area of approximately 308 523m^2 in extent (i.e. 0.6% of the site). Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal power line routes and the internal access roads. From the specialist investigations undertaken for the proposed wind energy facility development site, limited areas of potential high sensitivity were identified. These potentially sensitive areas include:

Drainage lines within the site

Local factors that may lead to parts of the study area having high ecological sensitivity are the presence of drainage lines on site and the potential presence of various plant and animal species of conservation concern. The drainage lines will potentially be impacted by the proposed power line and access roads (linear infrastructure panned for the site), and not the areas to be occupied by the wind turbines. However, the power line can span the drainage line and would easily be outside the recommended 32 m buffer. Crossing of these areas by internal access roads will be very localised and can be mitigated through the implementation of appropriate measures.

Areas of natural vegetation and sensitive habitats on site

The quartzitic hills on site are considered to be high sensitivity on account of the higher flora and fauna richness associated with these areas. However, there were few threatened species recorded within this habitat through the specialist investigations. With appropriate avoidance and mitigation measures the impacts on these rocky hills could be significantly reduced to acceptable levels. The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas.

In addition, various areas were identified as potential habitats for birds and bats. These habitats will need to be avoided as far as possible.

Heritage sites

10 sites were identified during the survey. None of these sites will be directly impacted by the proposed development. Most of the Stone Age archaeology in the study area consists of low densities of scattered (and mixed) Middle Stone Age (MSA) and Late Stone Age ((LSA) artefacts. These occurrences are documented as "find spots" and are of low significance but more substantial and higher significant MSA and LSA archaeological sites do occur, and were recorded as "sites". None of these find spots or sites will be impacted on by the proposed development. Apart from the Stone Age component a low circular stone enclosure was documented in the eastern portion of the study area. This site will not be impacted on by the proposed development.

If any archaeological material is uncovered during construction or operation a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered.

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 construction and operation of the proposed **Garob Wind Farm** conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. No absolute no-go areas were identified on the proposed development site, although some areas of potential sensitivity where additional mitigation would be required have been highlighted. The significance levels of the majority of identified negative impacts can generally be reduced to impacts of medium to low significance by implementing the recommended mitigation measures. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within **Appendix O**.

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

In order to ensure that impacts are mitigated to acceptable levels as detailed in this report, the following conditions would be required to be included within the environmental authorisation issued for the project:

» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices F to N should be implemented to limit the negative impacts and enhance the positives.
» 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 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 key in achieving the appropriate environmental management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.

» The preferred power line alternative for implementation is Option 1.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.
» Use existing infrastructure where possible to minimise potential ecological impacts from disturbance of vegetation.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» As far as possible, access roads and cable trenches which could potentially impact on sensitive areas should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
» Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
» Where drainage lines are required to be crossed by access roads, the relevant permits (or water use licences) must be applied for from the DWA.
» Ensure that power line towers are constructed at least 32 m from the drainage lines (i.e. span the watercourses).
» A comprehensive stormwater management plan should be compiled and implemented for the developmental footprint prior to construction.
» Implement appropriate erosion control measures, specifically in potentially sensitive areas identified within the EIA Report.
» Alien invasive plants should be controlled on site during construction, operation and decommissioning of the proposed facility and associated infrastructure.
» A detailed geotechnical investigation should be undertaken before the

engineering design phase to provide more detail. Specialist geotechnical input is recommended during the construction of foundations.

» A walk-though survey of final infrastructure positions for the wind energy facility and associated infrastructure (including the power line) should be undertaken by a specialist ecologist and heritage specialist prior to the commencement of construction. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.

» The results of the current pre-construction bird and bat monitoring should inform the need to implement additional mitigation measures, as well as the need to continue with post-construction monitoring.

» The management plan primarily focuses on the mitigation and management of potential secondary visual impacts, because the primary visual impact has very low mitigation potential. In this regard proper planning should be undertaken regarding the placement of lighting structures.

» Applications for all other relevant and required permits required to be obtained by Garob Wind Farm (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any drainage lines (should they be required).

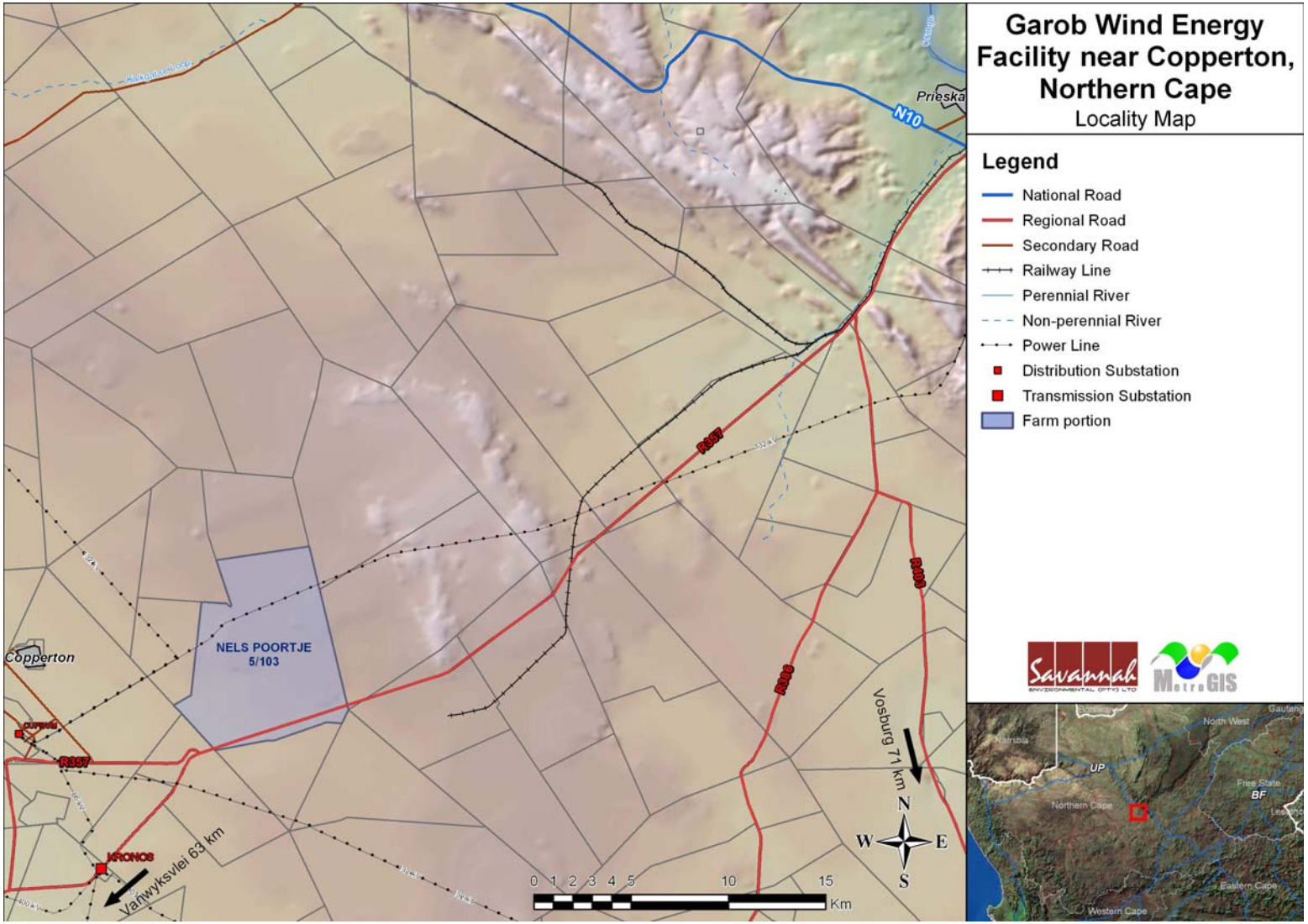

Figure 1: Locality map showing the study area for the establishment of the Garob Wind Farm located on Nelspoortje Farm, portio 5 of the Farm 103, located in the Siyathemba Local Municipality (Northern Cape

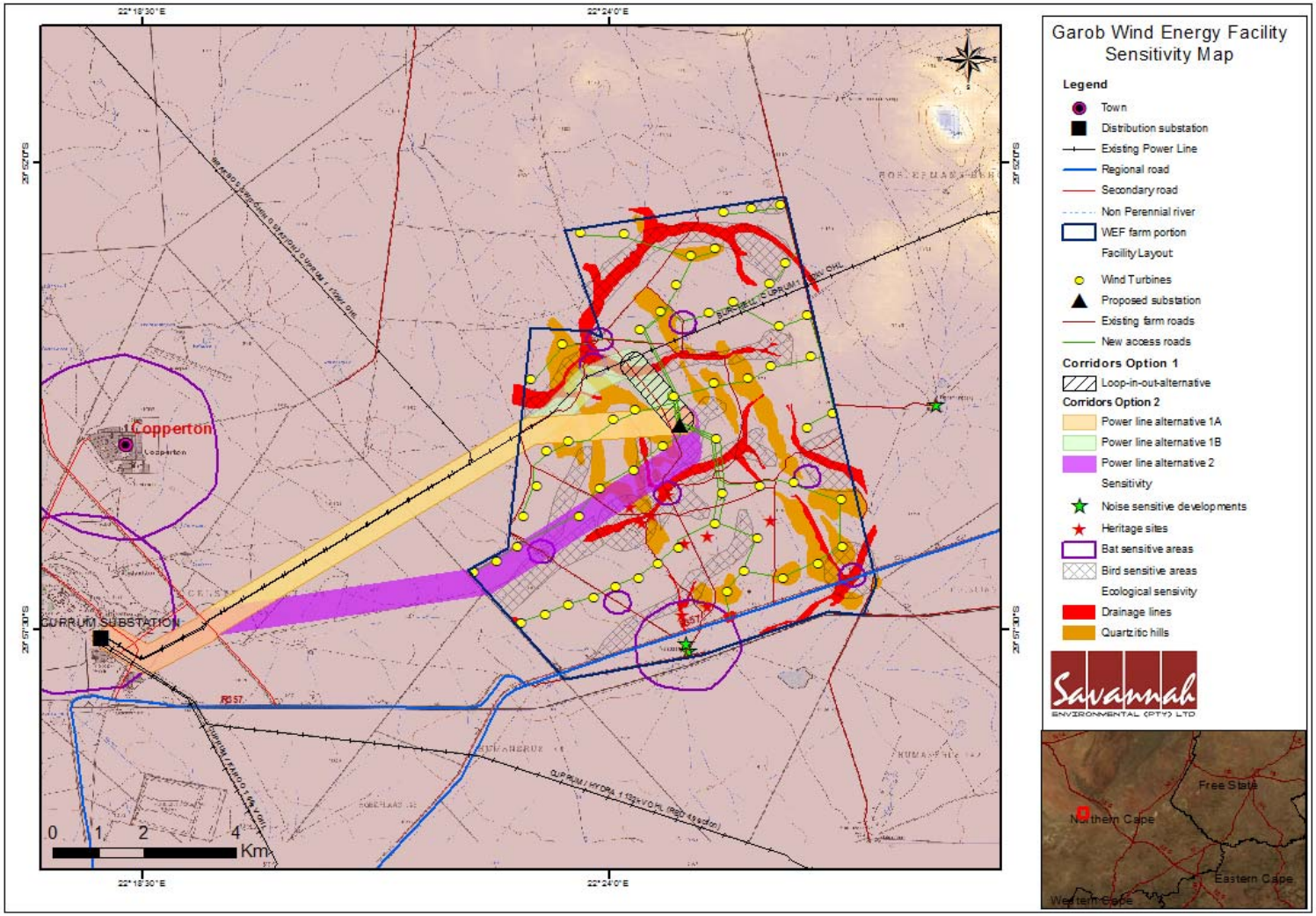

Figure 2: Environmental sensitivity map for the proposed Garob Wind Farm in relation to the proposed Facility layout**.**

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APPENDICES

DEFINITIONS AND TERMINOLOGY

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

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

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
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
DENC	Northern Cape Department of Environmental Affairs and Nature Conservation
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, Ordinance 15 of 1985
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAAO	South African Astronomical Observatory
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

INTRODUCTION CHAPTER 1

Garob Wind Farm (Pty) Limited is proposing the establishment of a commercial wind energy facility and associated infrastructure on an identified site located near Copperton in the Northern Cape Province of South Africa. The proposed site is located within the Siyathemba Local Municipality (within the Pixley ka Seme District Municipality), approximately 10 km east of the town of Copperton, and ~35 km south west of the town of Prieska. This proposed project will be referred to as the **Garob Wind Farm.**

The nature and extent of this facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Draft Environmental Impact Assessment (EIA) Report.

1.1. Summary of the proposed Development

The proposed site for the proposed Garob Wind farm was identified by juwi Renewable Energies (Pty) Ltd on behalf of Garob Wind Farm (Pty) Ltd through a Regional Assessment in the Northern Cape. The regional site identification process included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of a wind farm, including the wind resource, land availability, accessibility and existing grid infrastructure.

The facility is proposed on portion 5 of the Farm 103, (Nelspoortje farm) near Copperton, Northern Cape Province. The R357 from Prieska to Copperton crosses the southern section of the site while the existing Burchell/Cuprum 132 kV power line crosses the northern section of the site. Eskom's Cuprum substation (within the town of Copperton) lies approximately 8 km west of the site (refer to Figure 1.1). A broader study area of approximately 5520 ha is being considered within which the facility is to be constructed, although the actual development footprint of the proposed facility would be smaller in extent. Therefore, the wind turbines and the associated infrastructure can be appropriately placed within the boundaries of the broader site to avoid any identified environmental sensitivities.

Infrastructure associated with the **Garob Wind Energy Facility** will include:

- 58 **wind turbines** with a hub height of up to 100m and a rotor diameter of up to 120m. The facility will have a total generation capacity of up to 140 MW.
- Concrete **foundations** to support the turbines.
- **Cabling** between the turbines, to be laid underground where practical so to connect to the on-site substation.
- Internal **access roads** to each turbine (approximately 6 m wide) linking the wind turbines and other infrastructure on the site. Existing roads will be used as far as possible.
- An on-site substation to facilitate the connection between the wind energy facility and the electricity grid.
- New 132 kV overhead power line. Two options are being considered as follows (see also Figure 1.1 below) :
  - Option 1: Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
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    - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

Site-specific studies and assessments are currently being undertaken through an Environmental Impact Assessment process in order to confirm the environmental feasibility of the proposed project and to delineate any areas of environmental sensitivity within the study area. The current environmental investigations therefore consider the broader site in order to facilitate finalisation of the layout. The scope of the proposed Garob Wind Farm project, (for the construction, operation and decommissioning phases) is discussed in more detail in Chapter 5

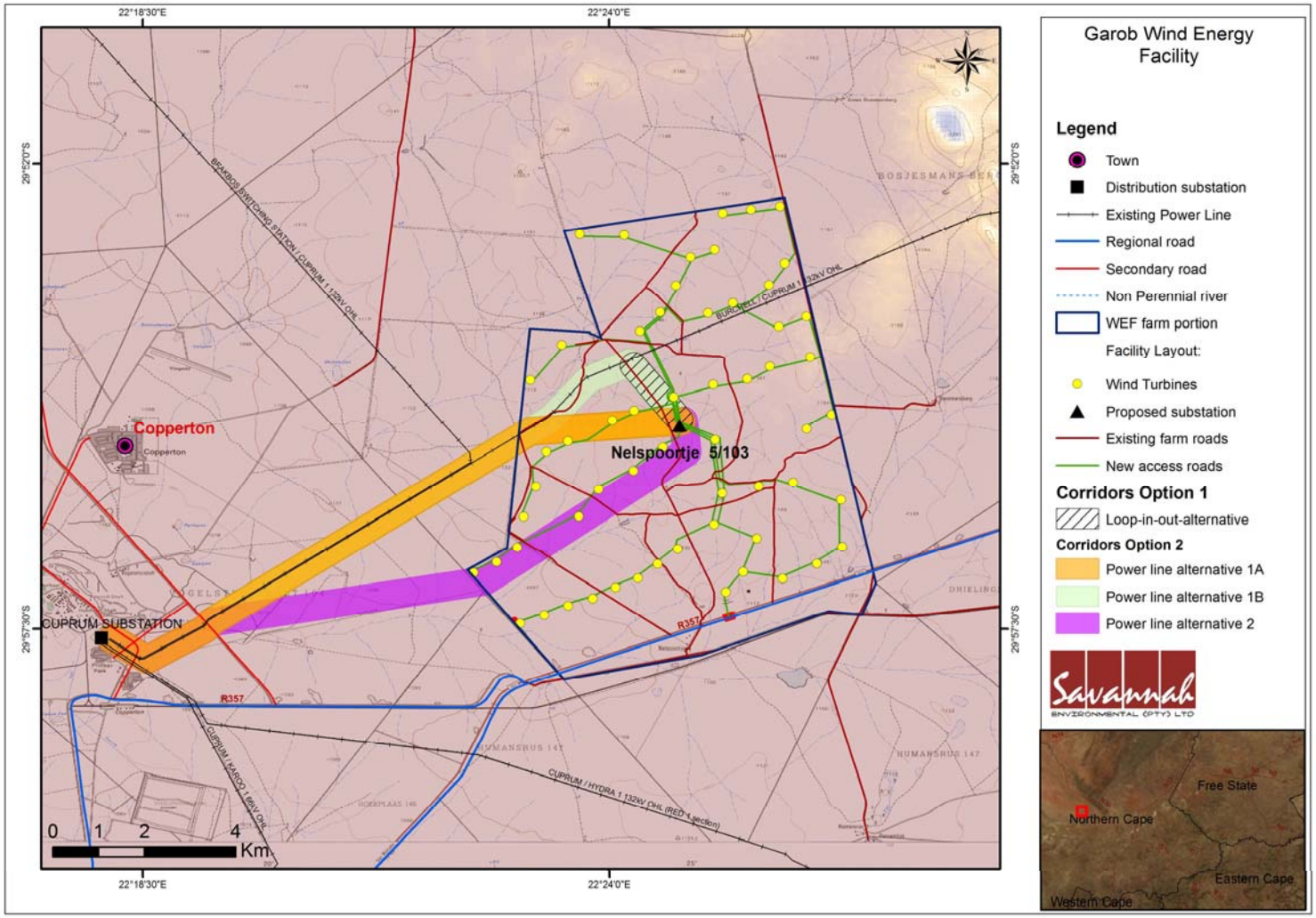


Figure 1.1: Preliminary layout showing the study area as well as proposed infrastructure for the Garob Wind Farm located on portion 5 of the farm Nelspoortje 103, within the Siyathemba Local Municipality (Northern Cape)

1.2. The need and desirability of the proposed project

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, Garob Wind Farm (Pty) Limited proposes the establishment of the Garob Wind Farm to add new capacity to the national electricity grid.

The proposed site for the Garob Wind Farm was identified by juwi Renewable Energies (Pty) Ltd on behalf of Garob Wind Farm (Pty) Ltd as a highly desirable site based on a pre-feasibility assessment that was conducted for a larger area within the Northern Cape. The proposed Garob Wind Farm site displays characteristics which make it a preferred site for a Wind Energy Facility. The proposed farm portion covers an area approximately 5520 ha in extent, with the majority of the site located on plains and the Burchell-Cuprum 132kV distribution power line traverses the northern portion of the site.

The construction phase for the proposed 140 MW Garob Wind Farm is expected to extend over a period of ~ 18 months and create approximately 266 construction related jobs. Of this total approximately 25% (67) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 35% (93) to semi-skilled personnel (drivers, equipment operators), and ~ 40% (106) to low skilled personnel (construction labourers, security staff). The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from Prieska and Marydale. 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.

The total wage bill with the construction of a 140MW Wind Farm (266 employees X 18 months) is estimated to be in the region of R 66 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 a significant opportunity for the local economy and businesses in Prieska.

The capital expenditure associated with the construction of a 140 MW Wind Farm will be in the region of R 2.5 billion. 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 wind energy facilities the opportunities for the local economy and towns such as Prieska, Upington and De Aar are likely to be limited. However, opportunities are likely to exist for local contractors and engineering companies in Upington and De Aar. 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 Prieska. 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.

The 140 MW Garob Wind Farm will create a limited number of employment opportunities during the operation phase (~ 16). Of this total 7 will be full time and 9 part time. The potential socio-economic benefits will therefore be limited. However, the majority of the employment opportunities are likely to benefit historical disadvantaged members of the community. The proponent has also indicated that they are committed to implementing a training and skills development programme during the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the Siyathemba Local Municipality IDP

The establishment of the proposed Garob Wind Farm also supports the objectives set out in the Northern Cape Provincial Growth and Development Strategy and the Pixley ka Seme District Municipality and Siyathemba Local Municipality IDPs, specifically the creation of employment and economic development opportunities. The proposed wind energy facility will also create opportunities to support SMMEs

and co-operation between the public and private sector in the Northern Cape Province.

1.3. Conclusions from the Scoping Phase

The broader study area (i.e. the farm portions in their entirety) was evaluated within the scoping study. No environmental fatal flaws were identified to be associated with the site. However, from the preliminary sensitivity analysis undertaken, potentially sensitive areas within the study site were identified. In order to reduce the potential for on-site environmental impacts, it was recommended that these areas be avoided as far as reasonably possible through the facility design/micro-siting exercise. These potentially sensitive areas identified through the scoping study include:

» *Drainage lines within the site* **-** There are a number of drainage lines that occur on the site[1].
» *Potential habitat for protected flora and fauna* - The gravel or stony outcrops on site are likely to be dominated by low woody shrubs. These are likely to be of medium ecological sensitivity due to higher plant and animal diversity.
» *Potential bird sensitive areas* - Surface water areas on site have been identified as potential habitats for avifauna and should be avoided.
» *Noise sensitive Receptors* - The construction and operation of the wind energy facility will have potential impacts on noise sensitive receptors within the proposed development.

It was therefore recommended by the scoping study that these areas of sensitivity be avoided as far as possible and/or impacts reduced where they cannot be avoided. This has been achieved through an effective design process of the different components of the facility during the EIA Phase

1.4. Requirement for an Environmental Impact Assessment Process

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

NEMA is the national legislation that provides for the authorisation of "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a

[1] According to the National Water Act, these are classified as wetlands or water resources.

proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as the commenting authority. An application for authorisation has been accepted by DEA under application reference number 14/12/16/3/3/2/279.

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 to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. juwi Renewable Energies (Pty) Ltd on behalf of Garob Wind Farm (Pty) Limited appointed Savannah Environmental (Pty) Ltd as the independent **Environmental Consultants** to conduct the EIA process for the proposed project.

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with **Interested and Affected Parties** (I&APs).

In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010).

Relevant Notice	Activity No	Description of listed activity	Applicability to the project
Government Notice R544, 18 June 2010	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 but less than 275kV;or.	Construction of a Power Line, Substation and associated cables between the wind turbines.
Government Notice R544, 18 June 2010	11	The construction of: (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures	Construction of infrastructure within 32 m of a drainage line or water course.

Relevant Notice	Activity No	Description of listed activity	Applicability to the project
		from the edge of a watercourse.	
GN 544, 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	The on-site storage of diesel and fuel in containers for construction machinery and vehicles.
GN 544, 18 June 2010	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	Potential activities required to cross watercourse for access roads and electrical cables
Government Notice R544, 18 June 2010	22	The construction of a road, outside urban areas, (ii) Where no road reserve exists where the road is wider than 8 metres	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 10 m in width.
Government Notice R544, 18 June 2010	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (i) where the existing road reserve is wider than 13.5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres	Existing farm (gravel) access roads may be widened and/or lengthened
Government Notice R545, 18 June 2010	1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	Establishment of a wind farm with a capacity of up to 140 MW.
Government Notice R545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;	The development footprint for the proposed wind energy facility will cover an area greater than 20 hectares.
Government Notice R546, 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation	Clearance of an area more than 5 hectares

The EIA phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of NEMA.

1.5. Objectives of the EIA process

The Scoping Phase which was completed in July 2012 (i.e. with the acceptance of scoping in September 2012) served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and 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 (i.e. the current phase) assesses identified environmental impacts (direct, indirect, and cumulative as well as positive and negative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning), and recommends appropriate mitigation measures for potentially significant environmental impacts. The release of this draft EIA Report provides stakeholders with an opportunity to verify that 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 phase prior to submission to DEA.

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

Savannah Environmental was appointed by juwi Renewable Energies (Pty) Ltd on behalf of the Garob Wind Farm (Pty) Limited (project Developer) as an independent consultant to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of the specialist sub-consultants on this project are subsidiaries of or affiliated to Garob Wind Farm (Pty) Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

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

The Savannah Environmental team 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 EAPs from Savannah Environmental who are responsible for this project are:

» *Karen Jodas* - a registered Professional Natural Scientist and holds a Master of Science degree. She has 16 years of experience consulting 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.

» *Bongani Darryl Khupe* – the principle author of this report is a registered Professional Natural Scientist who holds a Bachelor of Science Honours degree and has more than 6 years' experience in the environmental field. His key focus is on environmental impact assessments, environmental permitting, public participation, environmental management plans and programmes, strategic environmental advice, rehabilitation advice and monitoring, environmental compliance advice and monitoring as well as providing technical input for projects in the environmental management field. He is currently the responsible EAP for several renewable energy projects and other EIAs across the country.

» *Umeshree Naicker* - Holds an Honours Bachelor of Science degree in Environmental Science and has 4 years' experience in environmental management. Her key focus is on environmental impact assessments, environmental permitting, public participation, environmental management plans and programmes, environmental compliance advice and monitoring as well as providing technical input for projects in the environmental management field. She is currently the responsible EAP for several renewable energy projects and other EIAs across the country

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA Processes. Savannah Environmental has developed a valuable understanding of impacts associated with the construction and operation of renewable energy facilities.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

Specialist	Area of Expertise
Simon Todd of Simon Todd Consulting	Ecology
Jon Smallie of WildSkies Ecological Services	Avifauna
Claire Patterson-Abrolat and Megan Diamond of Endangered Wildlife Trust	Bats
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping
Jaco van der Walt of Heritage Contracts and Archaeological Consulting CC	Heritage
Tony Barbour Environmental Consulting and Research	Social
Louis George du Pisani and Theunis Gert Coetzee of Eduplan cc	Soils, erosion and agricultural potential
Morne de Jager of M2 Environmental Connections CC	Noise
Dr Jennifer Botha-Brink of the Karoo Palaeontology National Museum	Palaeontology

Refer to Appendix A for the curricula vitae for Savannah Environmental and the specialist sub-consultants team.

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 2

2.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is 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 2.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed wind energy facility.

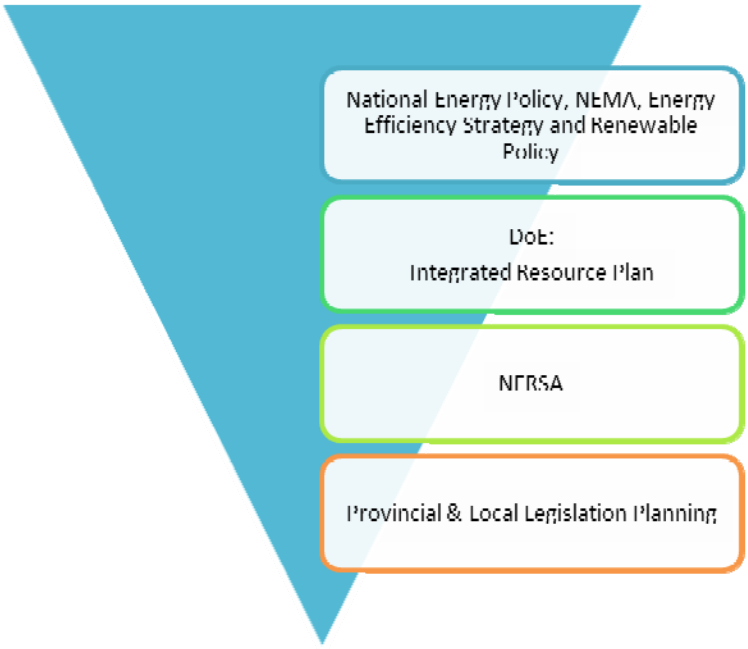


Figure 2.1: Hierarchy of electricity policy and planning documents

2.1.1. 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 DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, i.e.:

» increasing access to affordable energy services;
» improving energy sector governance;
» stimulating economic development;
» managing energy-related environmental impacts; and

» securing supply through diversity.

Furthermore, the National Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process and the adoption of a National Integrated Resource Planning (NIRP) approach. Through these processes, the most likely future electricity demand based on long-term southern African economic scenarios can be forecasted, and provide the framework for South Africa to investigate a whole range of supply and demand side options.

2.1.2. Renewable Energy Policy in South Africa

Internationally there is an increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and the exploitation of non-renewable resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

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. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

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. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with meeting the following challenges:

» Ensuring that economically feasible technologies and applications are implemented;
» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
» Addressing 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*."

2.1.3. 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; and
» 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 current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions

The document outlines the proposed generation new-build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. 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; and 8,9 GW of other generation sources. The Policy-Adjusted IRP therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW.

2.2. Provincial and Local Level Developmental Policy

2.2.1. Northern Cape Growth and Development Strategy (2004-2014)

The Provincial Growth and Development Strategy (PGDS) notes that the most significant challenge that the government and its partners in growth and development are confronted with is the reduction of poverty. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The PGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

» Agriculture and agro-processing;
» Fishing and mariculture;
» Mining and mineral processing;
» Transport;
» Manufacturing;
» Tourism.

However, the PGDS also notes that economic development in these sectors also requires:

» Creating opportunities for lifelong learning;
» Improving the skills of the labour force to increase productivity;
» Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

» Developing requisite levels of human and social capital;
» Improving the efficiency and effectiveness of governance and other development institutions;
» Enhancing infrastructure for economic growth and social development.

Of specific relevance to this project, the PGDS make reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape, the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the Province's natural resource endowments must be encouraged. In this regard the PGDS notes "the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc, could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The PGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The PGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the Province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape.

The PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the Province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. It is noted that attention should be paid to ensuring that the development of large

renewable energy projects, such as the proposed wind energy facility, do not negatively affect the region's natural environment or the tourism potential of the Province.

2.3.2. Siyathemba Local Municipality Integrated Development Plan (2010/ 2011)

The 2010/2011 Revision appears to be the most recent review of the Siyathemba Local Municipality IDP. Key aspects of relevance to the proposed Garob Wind Farm development are discussed below.

The IDP identifies the following Key Performance Areas (KPAs) as critical to achieving Council's vision:

» Local economic development and job creation;
» Municipal financial viability and management;
» Tourism and marketing;
» Municipal health ;
» Combating HIV/Aids;
» Crime and security, including disaster management.

With regard to local economic development (LED), goals identified in the IDP include:

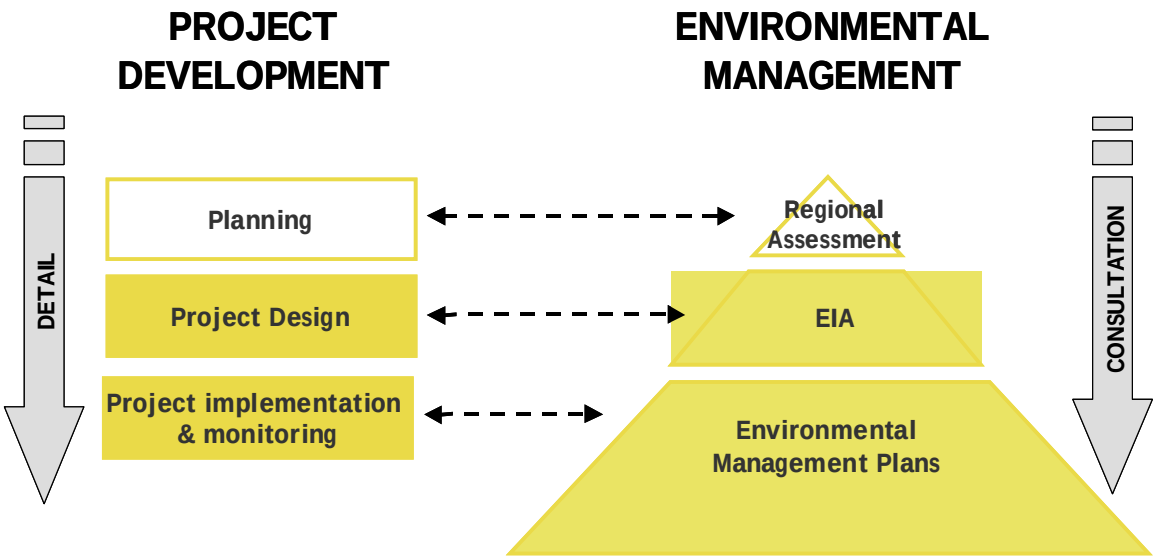
» The promotion of agriculture, tourism, mining and infrastructure development;
» The promotion of economic diversification, including Industry based on value-adding to local produce;
» Attracting and retaining capital in the Siyathemba Local Municipality.

Commercial renewable energy generation is not specifically addressed in the IDP.

2.2. Project Planning and the site-specific Environmental Impact Assessment

In terms of the EIA Regulations under NEMA, a Scoping and EIA report (including an environmental management programme (EMP)) are required to be compiled for this proposed project. The EIA is considered as an effective planning and decision-making tool in the planning process of a new power generation facility. It allows potential environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed through project design and implementation. The level of detail at a site-specific level is refined through the process, and allows for resolution of potential issue(s) through dialogue with affected parties.

The relationship between project development and the environmental assessment and management process is depicted in the figure below.



The project planning phase for the Garob Wind Farm included a detailed site selection process, and the environmental suitability of the site was confirmed through a Regional Assessment process undertaken by Savannah Environmental.

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, and produces an insignificant quantity of greenhouse gases in its life cycle. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard.

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

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 (i.e. wind) 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 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 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 5 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 will 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

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.

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 Garob Wind Farm in the Northern Cape will have a hub height of up to 100 m, and rotor diameter of 120 m.

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

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, concrete or a mixture of both. The tower proposed for the Garob Wind Farm is up to 100m in height. The nacelle and the rotor are attached to the top of the tower.

The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

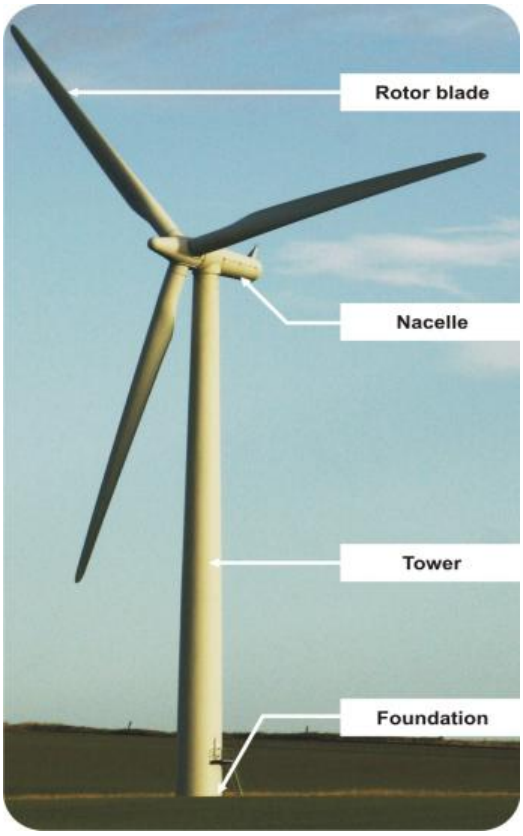


Figure 3.1: Illustration of the main components of a wind turbine

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.

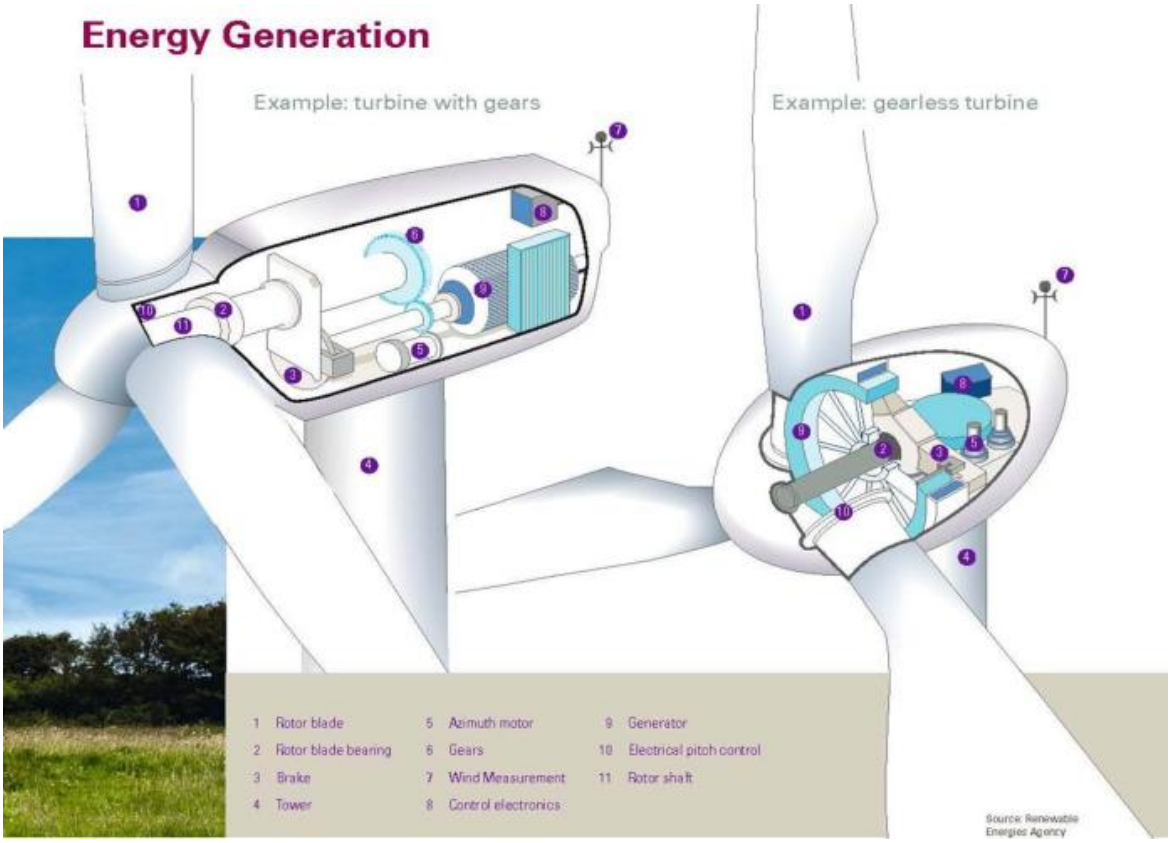


Figure 3.2: Illustration of the main components of a turbine with gears and without gears

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.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An EIA Process is dictated by the EIA Regulations which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project. The EIA process which comprises a **Scoping** and an **EIA Phase** culminates in the submission of an EIA Report, including an Environmental Management Programme (EMP) to the competent authority for decision-making.

The phases of the EIA process are as follows:

Figure 4.1: Phases within the EIA Process

The EIA Phase for the proposed Garob Wind Farm, associated infrastructure and associated power line 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.

4.1. Scoping Phase

The Scoping Report aimed at detailing the nature and extent of the proposed facility, 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, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and I&APs. In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives were investigated for consideration within the EIA process. However, no feasible and reasonable alternatives were identified for some aspects of the project. Details of alternatives considered and reasons for not considering some of the alternatives is detailed in Chapter 7.

The Scoping Phase also provided interested and affected parties (I&APs) with the opportunity to receive information regarding the proposed project, to participate in the process and to raise issues or concerns. To further facilitate this, the draft Scoping Report was made available for public review and comment at the following locations between 07 June 2012 and 06 July 2012:

» www.savannahsa.com
» Siyathemba Public Library
» Alpha Library
» Alkantpan Lodge

All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included within the Final Scoping Report, which was submitted to the National Department of Environmental Affairs (DEA) for acceptance, together with a Plan of Study for the EIA Phase. The Scoping Phase concluded in September 2012 with the acceptance of the final Scoping Report. In terms of this acceptance, an EIA was required to be undertaken for the proposed project as per the accepted plan of study. In addition, it is required that comments from the relevant organs of state are submitted with the Final Environmental Impact Report (EIR), and that the EIR report is to contain a construction and operational phase Environmental Management Programme (EMPr).

4.2. Environmental Impact Assessment Phase

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess identified feasible alternatives put forward as part of the project.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation 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 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.

4.3. Overview of the EIA Phase

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

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

4.3.1 Authority Consultation

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

» Submission of a final Scoping Report following a 30-day public review period and consideration of stakeholder comments received.
» Ad hoc discussions with DEA and Northern Cape DENC in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA Phase.

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

» Submission of a final EIA Report following the 30-day public review period.
» Provision of an opportunity for DEA representatives to visit and inspect the proposed site, and the study area.
» Consultation with Organs of State that may have jurisdiction over the project, including:
    * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water Affairs, South African

National Roads Agency Limited, Department of Agriculture, Department of Mineral Resources etc.).

* Government Structures (including the Department of Public Works, Roads and Transport, etc)

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

4.3.2 Public Involvement and Consultation

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

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

Below is a summary of the key public participation activities conducted during the EIA process.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by **Savannah Environmental** through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to Table 4.1).

Table 4.1: Key stakeholder groups identified during the EIA Process

Stakeholder Group	Department
National and Provincial Authorities and Organs of State	» National Department of Environmental Affairs » Department of Environment and Nature Conservation, Northern Cape » Department of Energy » Department of Water Affairs » Department of Agriculture, Forestry and Fisheries » South African Heritage Resources Agency » South African National Roads Agency Limited » Department of Mineral Resources

	» Department of Science and Technology
Municipalities	» Siyathemba Local Municipality » Pixley ka Seme District Municipality
Public stakeholders	» Adjacent and surrounding landowners
Parastatals & service providers	» Eskom Distribution and Transmission
NGOs/Business forums	» Wildlife Society of South Africa » SKA » Engendered Wild Life Trust

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C). 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.

» **Newspaper Advertisements**
As part of the EIA phase a newspaper advert was placed in the Volksbad and Gemsbok to:

- notify and inform the public of the proposed project and invite members of the public to register as I&APs
- inform the public of the public meeting and the review period for the Draft EIA Report

The adverts were placed as follows

- Afrikaans advert on the Volksbad
- English advert on the Gemsbok

» **Stakeholder Engagement**
In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:

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

The public meeting will serve to provide feedback on the findings of the EIA studies undertaken. Stakeholders are invited to attend the public meeting to be held as follows:

Date: 5 December 2012
Time: 16:00
Venue: Nelspoortjie Karoo Guest Farm (48 Km out of Prieska on the Copperton/Vanwyksvlei tar road)

Records of all consultation undertaken during the EIA phase will be included within Appendix E.

4.3.3 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Report (refer to Appendix E for the Comments and Response Reports compiled through the EIA Process to date).

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

4.3.4 Assessment of Issues Identified through the Scoping Process

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

Table 4.1: Specialist studies undertaken within the EIA Phase

Specialist	Area of Expertise	Appendix
Simon Todd of Simon Todd Consulting	Ecology	Appendix F
Jon Smallie of WildSkies Ecological Services	Avifauna	Appendix G
Claire Patterson-Abrolat and Megan Diamond of Endangered Wildlife Trust	Bats	Appendix H
Louis George du Pisani and Theunis Gert Coetzee of Eduplan cc	Soils, erosion and agricultural potential	Appendix I
Morne de Jager of M2 Environmental Connections CC	Noise	Appendix J
Lourens du Plessis of MetroGIS	Visual impacts	Appendix K
Tony Barbour Environmental Consulting and Research	Social	Appendix L
Jaco van der Walt of Heritage Contracts	Heritage	Appendix M

and Archaeological Consulting CC		
Dr Jennifer Botha-Brink of the Karoo Palaeontology Department National Museum	Palaeontology	Appendix N

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Garob Wind Farm. 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
  * 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)
  * 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 where:
  * 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)
  * 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 the project developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft EMP is included as Appendix O.

4.3.5 Assumptions and Limitations

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

» All information provided by Garob Wind Farm and/or I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site identified by Garob Wind Farm represents a technically suitable site for the establishment of the proposed wind facility.
» It is assumed correct that the proposed connection to the National Grid is feasible in terms of viability and need.
» Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.

» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies in Appendices F – N for specialist study specific limitations.

4.3.6 Public Review of Draft EIA Report

This Draft EIA report has been made available for public review from **09 November 2012 to 10 December 2012** at the following locations:

» www.savannahsa.com
» Siyathemba Public Library
» Alpha Library
» Alkantpan Lodge

All registered I&APs were notified of the availability of the report and public meeting by letter. An advert has been placed in the Volksbad and Gemsbok, to inform the public and I&APs of the availability of the Draft Environmental Impact Report (EIR) for review and invite I&APs to attend the public meeting (refer to Appendix E).

4.3.7 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 the EIA report. The Final EIA report will be submitted to the decision-making Authorities, and it is this Final report upon which a decision will be made regarding the proposed project.

4.4. Regulatory and Legal Context

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.

As wind energy development is a multi-sectoral issue (encompassing economic, spatial biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for wind energy facility project and the related statutory environmental assessment process.

4.4.1. Regulatory Hierarchy

At the 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 provides 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 Fishery (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.

At the Provincial Level, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environment and Nature Conservation (DENC):* This Department is the commenting authority for this project.
» *Department of Transport and Public Works (Northern Cape):* This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for all heritage related issues in the Northern Cape Province.

» *The Department of Agriculture:* This Department is responsible for all matters which affects agricultural land.
» *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 Siyathema Local Municipality was identified as having jurisdiction over the area in which the proposed facility is foreseen to be established. The Siyathemba Local Municipality forms part of the Pixley ka Seme District Municipality. Both of these municipalities have been consulted throughout the EIA process.

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

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

The following legislation and guidelines have informed the scope and content of this 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)
» Siyathemba Local Municipality Integrated Development Plan (2010/ 2011)
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in the EIA process, and the various permitting requirements associated with the proposed Wind Energy Facility. A listing of relevant legislation and permitting requirements is provided in Table 4.2 overleaf.

Table 5.1: Initial review of relevant policies, legislation, guidelines and standards applicable to the proposed Garob Wind Farm

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 544 - 546 of June 2010 a Scoping and EIA Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority NC Department of Environment and Nature Conservation – commenting authority	The listed activities triggered by the proposed wind energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA). This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life cycle of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs NC Department of Environment and Nature Conservation Local Authorities	Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. Therefore is no requirement for a noise permit in terms of the legislation. On-site activities should be limited to 6:00am - 6:00pm, Monday – Saturday (excluding public holidays). Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval obtained from DEA and the Local Municipality.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation.	Department of Water Affairs Provincial Department of Water Affairs	A water use license (WUL) is required to be obtained if drainage lines are impacted on and/or if water is to be abstracted from a natural resource (surface or groundwater), unless a General Authorisation applies.
National Water Act (Act No 36 of 1998)	In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	Department of Water Affairs Provincial Department of Water Affairs	This section of the Act will apply with respect to the potential impact on drainage lines, primarily during the construction phase (i.e. pollution from construction vehicles).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	In terms of subsection (2) of Section 53(1) of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) any person who intends to use the surface of any land in any way which may be contrary to any object of the Act or which is likely to impede any such object must apply to the Minister for approval.	Department of Mineral Resources	The developer must apply to the Minister for approval to use the surface of the property for the proposed development.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	S18, S19, and S20 of the Act allow certain areas to be declared and managed as "priority areas." Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.	Department of Environmental Affairs	No permitting or licensing requirements arise from this legislation. 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)	S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: » The construction of a road, power line, pipeline, canal or other similar linear	South African Heritage Resources Agency	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	Applicable Requirements	Relevant Authority	Compliance Requirements
	development or barrier exceeding 300 m in length; and » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. Stand alone HIAs are not required where an EIA Process is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		A Heritage Impact Assessment has been undertaken as part of the EIA Process to identify heritage sites. SAHRA has been consulted as required in terms of the this Act. See Appendix M.
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of S57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify	Department of Environmental Affairs	As the applicant will not carry out any restricted activity, as is defined in S1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies have been undertaken as part of the EIA Phase (refer to Appendix F, G and H). As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	permitting requirements at an early stage of the EIA Phase. The Act 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).		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species » Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Weeds are described as	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.		authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
National Forests Act (Act No. 84 of 1998)	» In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". » GN 1042 provides a list of protected tree species.	National Department of Forestry	Should any protected tree species be identified on the proposed development site and be impacted by the development, a permit would need to be obtained.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S21 the applicant would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of S12 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.	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, and this Act will find application during the construction and operational phase of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.		
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to 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 as Group I or Group II substance Group IV: any electronic product; and 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.	Department of Health	It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S2 - 4 provide general principles for land development and conflict resolution.	Local Municipality District Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	Local Municipality District Municipality	Subdivision approval in terms of S24 and S17 of the Act will be required should there be need to subdivide the farm.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 718), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.	National Department of Water and Environmental Affairs Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMP (refer to Appendix O). The volumes of waste to be generated and stored on the site during construction and operation of the facility will not require a waste license (provided these remain below the prescribed thresholds as detailed in GN718).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
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	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	» 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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		components may not meet specified dimensional limitations (height and width).
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.	Department of Environmental Affairs	No permitting or licensing requirements.
Promotion of Administrative Justice Act (Act No 3 of 2000)	In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable, and rational decisions. Interested and affected parties have right to be heard.	Department of Environmental Affairs	No permitting or licensing requirements.
Provincial Legislation			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	Provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the	Northern Cape Department of Environment and Nature Conservation	A permit is required for any activities which involve species listed under schedule 1 or 2. The DENC permit office provides an integrated permit which can be used for all provincial

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	following section may be relevant with regards to any security fencing the development may require. **Manipulation of boundary fences** 19. No Person may – (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom; The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1.		and Threatened or Protected Species (TOPS)-related permit requirements.

SCOPE OF THE WIND ENERGY FACILITY PROJECT CHAPTER 5

This chapter provides details regarding the scope of the proposed Garob Wind Energy Facility, including all required elements of the project and necessary steps for the project to be developed. The scope of the project includes construction, operation and decommissioning activities.

5.1 Project Construction Phase

In order to construct the proposed wind farm and associated infrastructure, a series of activities will need to be undertaken. The construction phase for the proposed 140 MW Garob Wind Farm is expected to extend over a period of ~ 18 months. There will be more than one crew operating on the site at any one time during this period. Construction crews will constitute mainly skilled and semi-skilled workers. No contractors (other than security personnel) will reside on the site at any time during the construction or operational phases.

The following activities will be undertaken during the construction phase of the project.

5.1.1. Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to:

» Geotechnical survey to provide information regarding subsurface characteristics for founding conditions and road building. This process will be required to be undertaken by a qualified geotechnical engineer.
» Wind energy facility site survey and confirmation (and pegging) of the turbine micro-siting footprints, laydown areas and access road routes. This micro-siting exercise will be required to be undertaken in conjunction with qualified heritage and vegetation specialists.
» Survey of substation site. This will be required to be undertaken in conjunction with qualified vegetation specialist.
» Survey and profiling of power line servitude to determine specific tower locations. This profiling exercise will be required to be undertaken in conjunction with qualified heritage, vegetation and avifauna specialists.

Garob Wind Farm (Pty) Ltd and juwi Renewable Energies have utilised specialist software to assist in selecting the optimum position for each turbine (for optimum power generation). This site layout optimisation exercise revealed the best possible positions for the turbines, as well as the substation and other infrastructure from a

technical perspective. The positioning/layout of all the components of this wind energy facility have a 90% confidence level, and will be confirmed through the results of the surveys mentioned above.

5.1.2 Establishment of Access Roads to the Site

The proposed site is accessible from the R357 from Copperton to Prieska. Access/haul roads to the site (if required) as well as internal access roads within the site are required to be established prior to the commencement of construction. As far as possible, existing access roads would be utilised, and upgraded where required. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Special haul roads of up to 7m in width will need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines.

These access roads will be constructed in advance of any components being delivered to site, and will remain in place after completion of construction activities for future access and maintenance. It is proposed that in preparing the access road, a portion of it (up to 7m in width) will be constructed as a permanent access road and the remainder as a temporary access road (temporary access road could be wider) that can be de-compacted and returned to its pre-construction condition.

5.1.3. Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each turbine, the establishment of internal access roads (as discussed in 5.1.2 above) and excavations for foundations (refer to 5.1.4 below). These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or used to rehabilitate the site.

Site preparation will be undertaken in a systematic manner to reduce the risk of the open ground to erosion. In addition, site preparation will include search and rescue of floral species of concern (where required), as well as identification and excavation of any sites of cultural/heritage value (where required).

5.1.4 Construct Foundation

Concrete foundations will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 4 m, depending on the local geology. Concrete may 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 up to a week to cure.

Figure 5.1: Photograph illustrating the construction of the foundation for a wind turbine (photo sourced from www.blm.gov)

Figure 5.2: Photograph illustrating a completed foundation for a wind turbine (photo sourced from www.juwi.com)

5.1.5. Transport of Components and Equipment to Site

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

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

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

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

5.1.6. Establishment of lay down areas on site

Laydown areas will need to be established at each turbine position for the storage and assembly of wind turbine components (an area approximately 52m^2). The laydown area will need to accommodate the cranes required in tower/turbine assembly.

In addition a number of construction compound areas will need to be established around the site. These will be temporary structures for site offices, storage and safe refuelling areas.

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

Figure 5.3: Photograph illustrating an example of laydown areas for a wind turbine. The soil stock piles to be reused during rehabilitation can also be seem around the laydown area (photo sourced from www.juwi.com)

5.1.7. Construct Turbine

A large lifting crane and an assisting small crane will be brought onto site (see Figure 5.3 above), these will be used to lift the various turbine components. These two cranes will lift the tower sections into place, before the nacelle, which contains the gearbox, generator and yawing mechanism, are placed on the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground which will then be lifted to the nacelle and bolted into place.

5.1.8 Construct Substation/s

One substation will be constructed within the site with a foot print of approximately 12 000m^2. The turbines will be connected to the substation via underground cabling which will follow the road network wherever possible. The position of the substation will be informed by the final micro-siting/positioning of the wind turbines. The layout of the turbines will determine the optimum position for the construction of the substation.

The construction of the substation will require a survey of the site; site clearing and levelling; construction of access road/s to the substation site (where required);

construction of substation terrace and foundations; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas as well as protection of erosion sensitive areas.

5.1.9 Connection of Wind Turbines to the Substation

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

5.1.10 Connect Substation/s to Power Grid

A 132 kV power line will connect the substation/s to the electricity distribution network/grid. Two alternative points of connection include:

- Option 1: Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
- Option 2: would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
  - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
  - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

The connection point to the Eskom power grid will be confirmed through a network planning exercise. A route for the power line will be assessed, surveyed and pegged prior to construction.

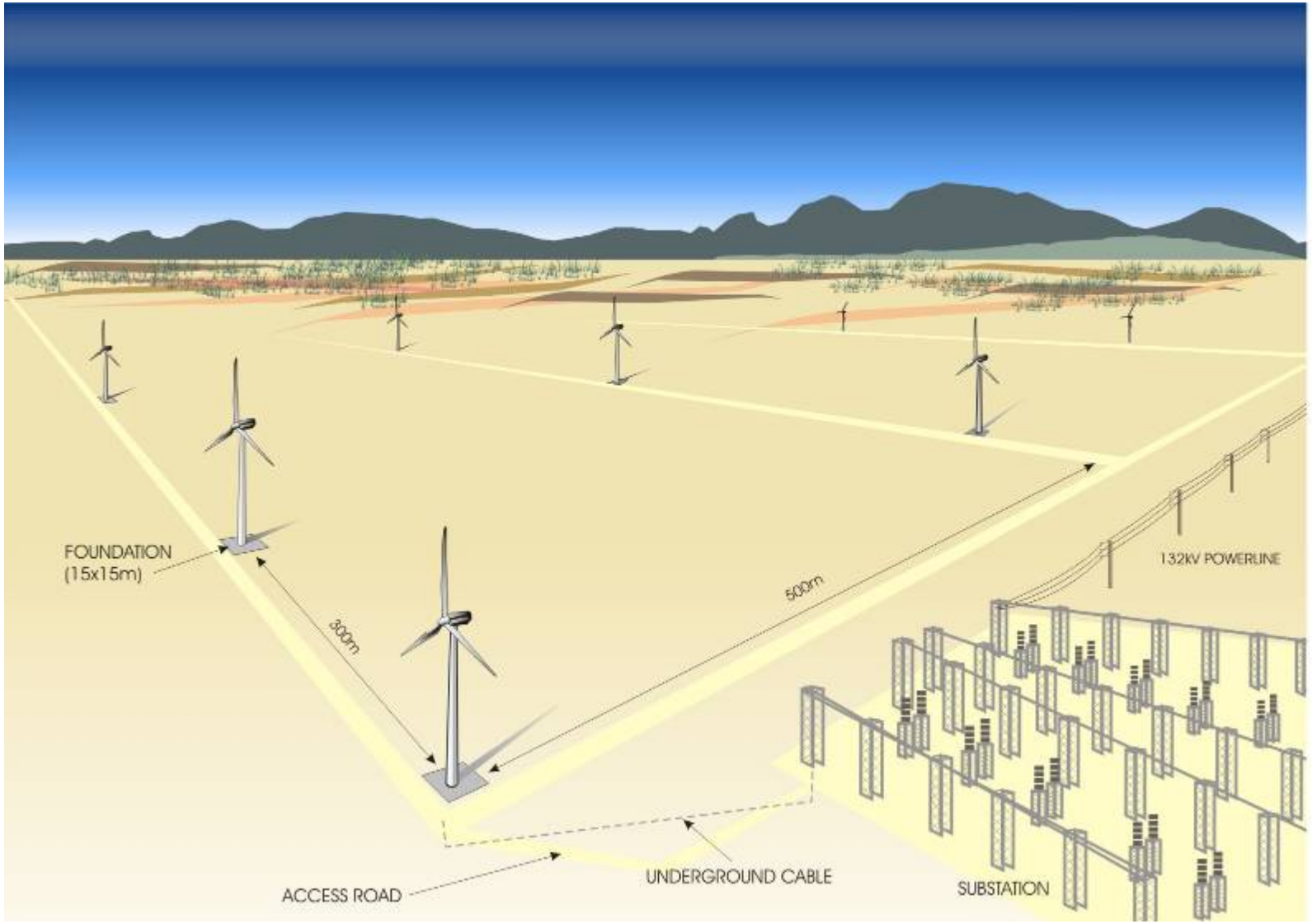


Figure 5.4: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

5.1.11. Commissioning

Prior to the start-up of a wind turbine, a series of checks and tests will be carried out. This will include 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 and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. The schedule for this activity will be subject to site and weather conditions.

5.1.12. Undertake Site Rehabilitation

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

5.2. Project Operation Phase

Based on information from other wind energy facilities the establishment of a 140 MW wind energy facility will create approximately 40 permanent employment opportunities. The operational phase is expected to last 20 years. Of this total approximately 20% (8) will be available to skilled personnel and 80% (32) to semi and low skilled personnel. 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.
Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions or maintenance activities.

5.2.1. Maintenance

The wind turbine will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.

5.3. Decommissioning

The turbine infrastructure which will be utilised for the proposed Garob Wind Farm is expected to have a lifespan of approximately 20 - 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that 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.

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

5.3.1. Site Preparation

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

5.3.2. Disassemble and Replace Existing Turbine

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable, except for the blades which are not recyclable at this stage.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the Draft EIA Report provides a description of the environment from a desktop perspective that may be affected by the proposed Garob Wind Farm, located near Copperton (8 km west of the proposed site) in the Northern Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected desktop 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 impact assessment reports contained within Appendices F to N.

6.1 Regional Setting and the Study Area

6.1.1 Regional Setting

The proposed Garob Wind Farm site is located in the sparsely populated, arid Karoo region, approximately 8 km east of the small former mining town of Copperton, within the Siyathemba Local Municipality. The main settlements in the Siyathemba Local Municipality are the towns of Prieska, Marydale, Niekerkshoop, Draghoender and Copperton.

The town of Prieska, which is the administrative seat of the Siyathemba Local Municipality, is located on the southern bank of the Orange River, approximately 35 km north east of the proposed site. Prieska is by far the largest town in the Siyathemba Local Municipality, and functions as the leader town in the municipality.

6.1.2 The study area

The broader study area[8] includes the towns of Copperton and Prieska. In addition, a number homesteads are dotted throughout the study area at low density. A number of arterial roads traverse the broader study area. These include the R357 (which bisects the southern portion of the site) linking Prieska and Copperton, the R386 and the R403. A few secondary roads are also present in the vicinity of Prieska and Copperton respectively. A railway line also runs between Copperton and Prieska, roughly following the alignment of the R357. The final 30 km or so of the line to the mine has however been decommissioned.

[8] The broader study area encompasses a geographical area of approximately 2136km².

Industrial-type infrastructure includes old mining infrastructure in and around Copperton and some industry / mining in Prieska. In addition, a number of power lines are present, including the Burchell-Cuprum 1 (132kV) power line, which traverses the site, and four others ranging from 132kV to 400kV.

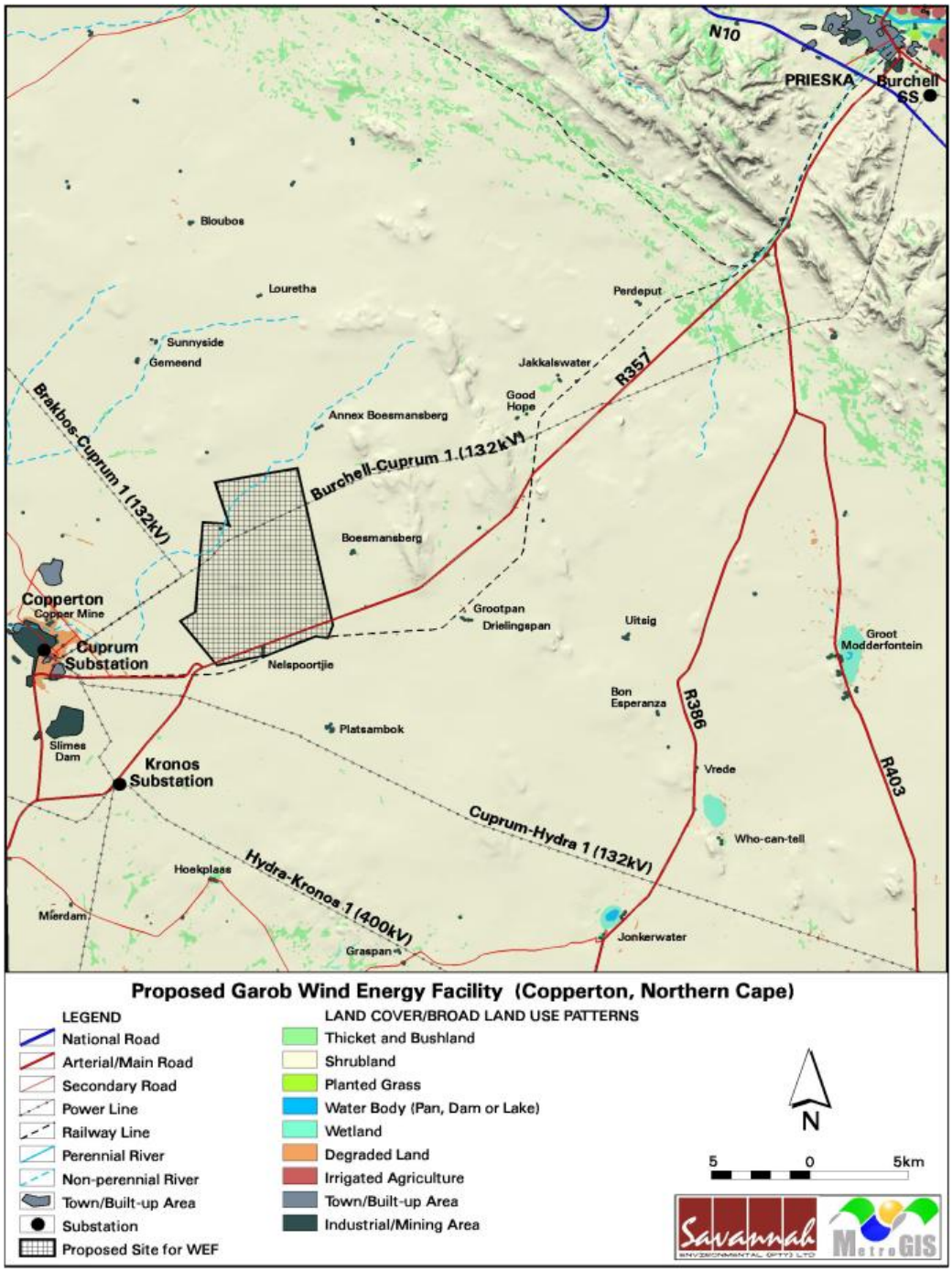


Figure 6.1: Land cover/land use map of Portion 5 of the Farm Nelspoortje No. 103, as well as the broader study area

6.2 Climatic Conditions

The climate of the area is categorised as arid. The average annual temperate is 20 – 22,5 (°C) degrees Celsius and the mean annual rainfall of the area is approximately 200 mm. The rainfall is unreliable and the precipitation is mainly due to convectional showers in summer and autumn, with the height of the rainfall season occurring between the months of February and April (single, very rare, heavy showers can account for as much as the normal annual precipitation).

6.3 Biophysical Characteristics of the Study Site and Surrounds

6.3.1 Topography

The broader study area is characterised by terrain that ranges in elevation from about 920 m above sea level (asl) along the Orange River (located just north east of Prieska) to about 1360 m asl at the tops of the Doringberge in the north east of the study area. The site (Portion 5 of the Farm Nelspoortje No. 103) lies at an elevation of about 1100 m – 1140 m asl (refer to Figure 6.2 below).

The topography consists of *slightly irregular plains and hills*. The Doringberge lie in the far north east of the broader study area, with some smaller local hills situated in closer proximity to the site, to the north east. The terrain on and immediately surrounding the site is relatively flat.

6.3.2 Hydrology

The most significant hydrological feature within the region is the Orange River, which lies just beyond of the town of Prieska in the north east. A few non-perennial tributaries draining to the north east and south west are present in the broader study area. Some isolated pans / wetlands are located in the south east of the study site.

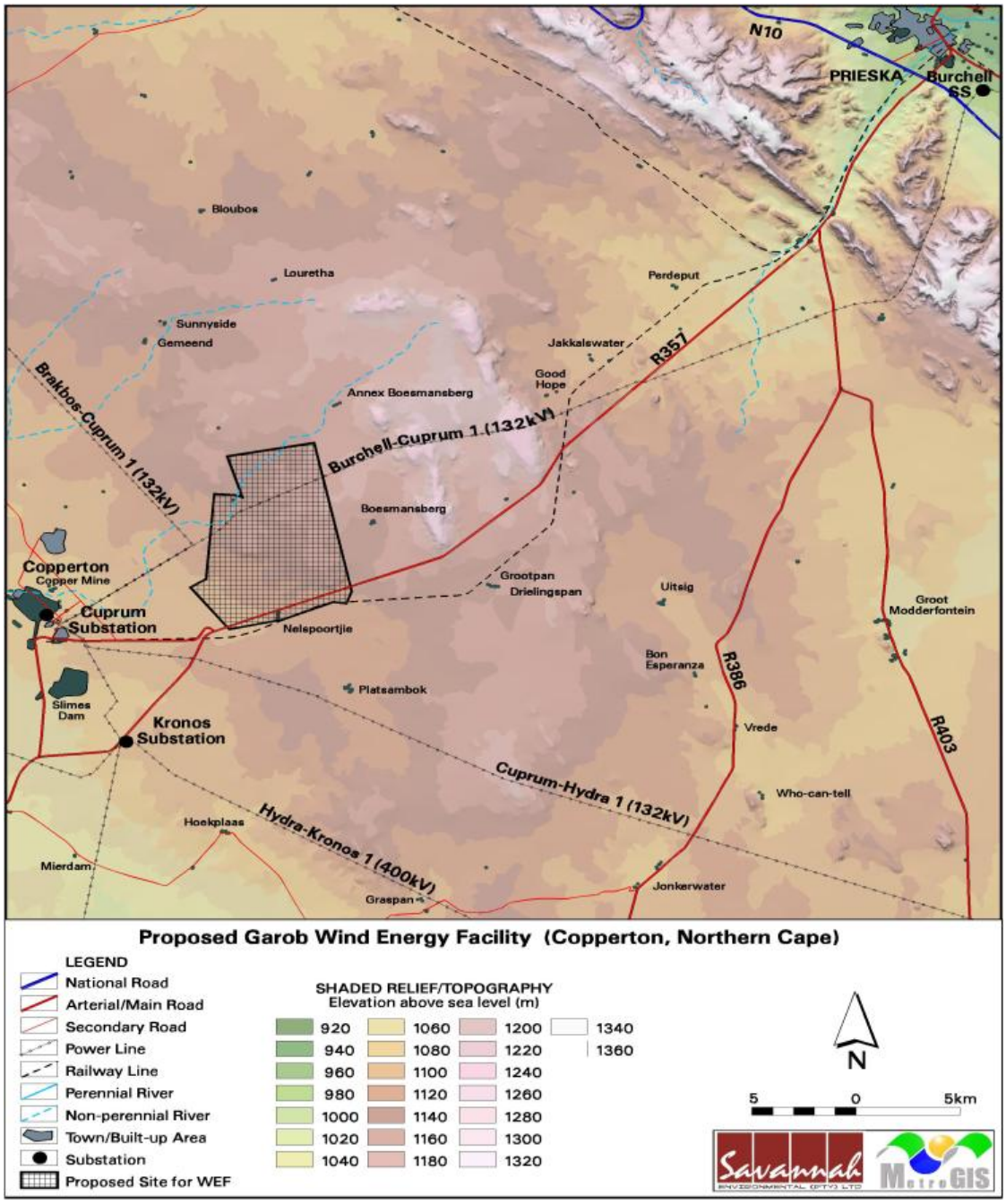


Figure 6.2: Shaded relief map indicating the location of the proposed facility and the topography and elevation above sea level

6.3.3 Soils, Land Use and Agricultural Potential

The geology of this area is dominated by Granite and Meta-Sediments of the Namaqualand Metamorfic Complex. The site is situated within the Ag Land Type.

Land Type Ag

The A group of land types has yellow and red soils without water tables and the following soil forms are prevalent, i.e. Clovelley, Griffin, Hutton, Inanda, Kranskop

and Magwa. The area is dominated by moderately deep Hutton soils and shallow soils of the Glenrosa and Mispah forms. According to the classification of the AGIS Website of the Department of Agriculture, Fisheries & Forestry and Department of Agricultural Development (1991), the site falls within an area with soils with minimum development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils, and where lime is rare or absent in the landscape. The soils are slightly susceptible to both water and wind erosion.

Land capability and land use:

The farm is currently used for sheep, goat and game farming, with Dorper sheep farming being the main enterprise. The land is currently stocked at approximately 20 ha/LSU[4]. There is no arable land present on the site, nor has there been any dryland farming practiced on any part of the land. There is approximately 1 ha of olive grove under drip irrigation next to the homestead. This land falls outside of the wind farm footprint.

Insufficient quantities of water are available for irrigation purposes. Water for livestock consumption is extracted from bore holes dispersed over the property. The average depth of the bore holes is 30m. The average annual rainfall over the last 10 years is 300mm (as per personal interview with landowner).

Agricultural potential:

The agricultural potential of the site is relatively poor and is limited to extensive grazing due to the very low rainfall and limited water availability. There is no identified agriculturally important infrastructure (i.e. silos, irrigation lines, pivot points, channels and feeding structures, etc.) or any conservation works (i.e. contour banks, waterways, etc.) located on the site.

6.3.4 Ecological Profile of the Study Area

Vegetation

According to the national vegetation map (Mucina & Rutherford 2006), the study area lies within the Bushmanland Arid Grassland vegetation type. This is an extensive vegetation type in the Northern Cape that stretches from Aggeneys in the west to Prieska. Less than 1% has been transformed and the vegetation type is classified as Least Threatened.

[4] The Livestock Unit, LU or LSU is a measure of livestock grazing in agriculture, expressed either as a total for a whole field or farm, or as units per hectare (ha) or acre.

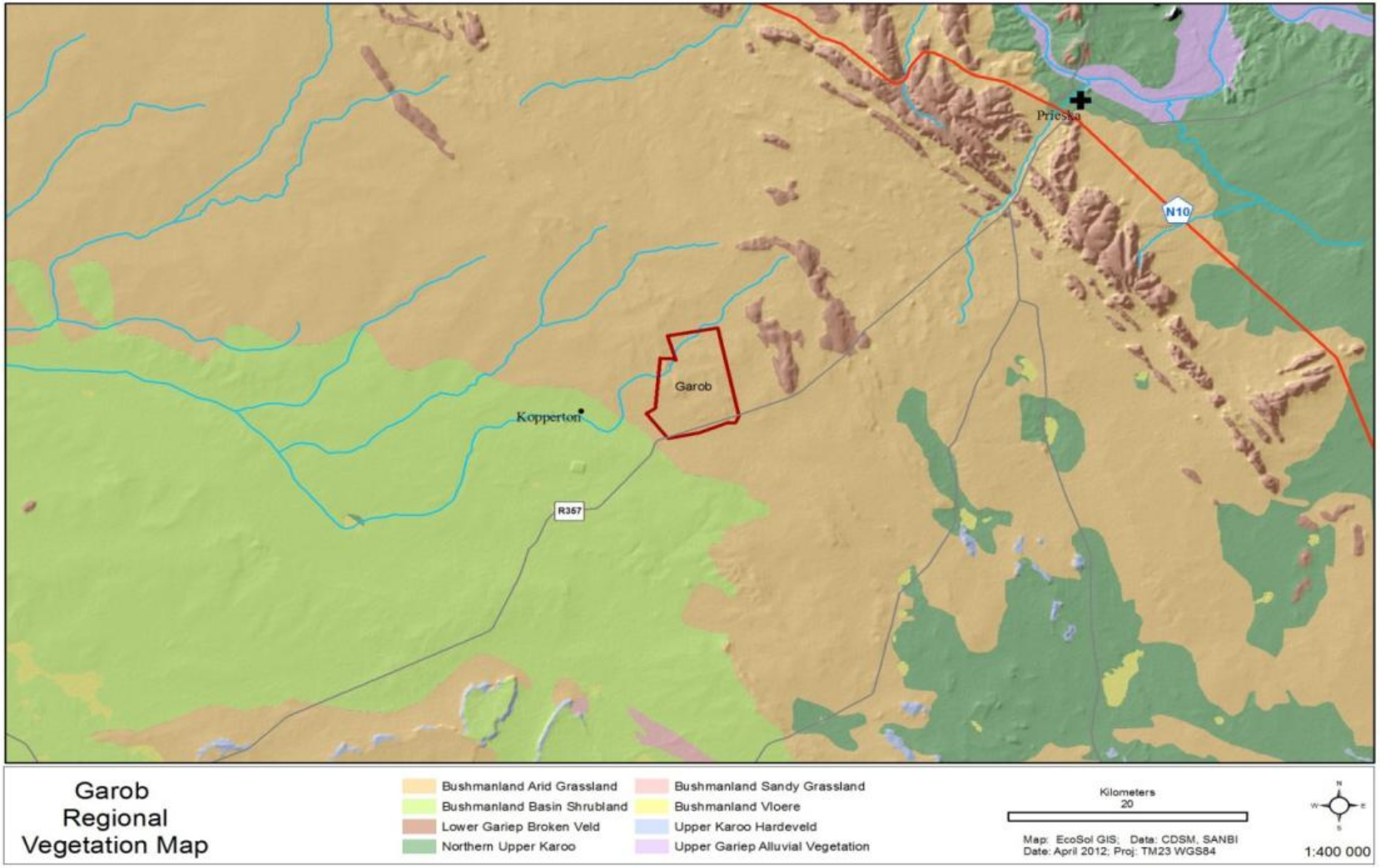


Figure 6.3: The broad-scale vegetation types surrounding the proposed Garob Wind Farm. Although the entire site falls within the Bushmanland Arid Grassland vegetation type, the presence of rocky areas and drainage lines on the site suggest that several distinct plant communities are likely to be present

Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is relatively few given the extensive nature of the vegetation type. Other vegetation types which occur in the vicinity are Bushmanland Basin Shrubland and Lower Gariep Broken Veld. The site visit clearly demonstrated that the vegetation of the site cannot be considered to represent only Bushmanland Arid Grassland. Indeed, Mucina & Rutherford (2006), recognized that along the eastern border of the vegetation type it often intermingles with Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Such intermingling of vegetation types is a conspicuous feature of the site, which also contains extensive elements of Lower Gariep Broken Veld and Bushmanland Basin Shrubland.

Within the site, several different plant communities could be recognised, each associated with the different substrate (also see Figure 6.4):

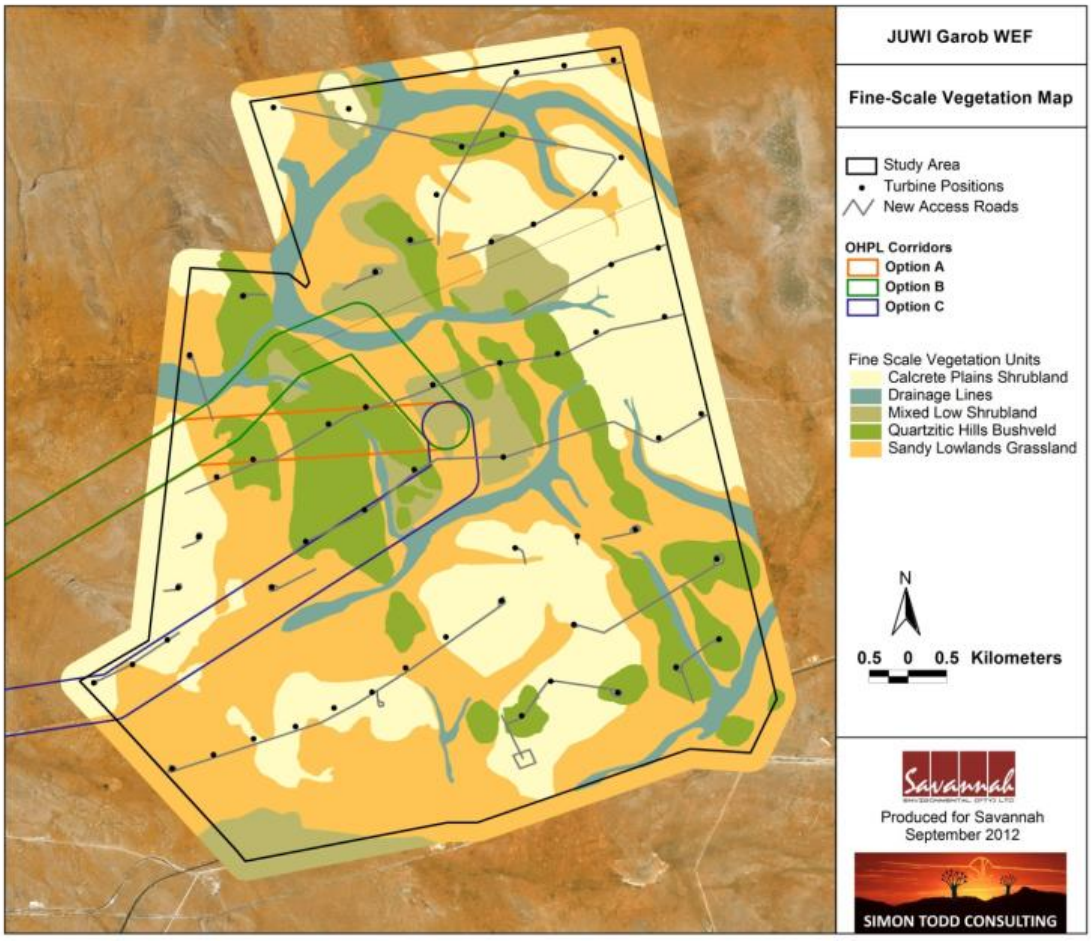


Figure 6.4: Fine-scale vegetation map of the Garob wind farm site. (Each of the different vegetation types depicted above are described in detail below).

» *Sandy Lowlands Grassland:* The lowlands of the site, which occur on deep sands can be considered to be representative of the Bushmanland Arid Grassland vegetation type of Mucina & Rutherford (2006). These areas are dominated by perennial grasses such as *Stipagrostis ciliata, S.obtusa, S.anomala, S.uniplumis and Schmidtia kalahariensis;* with varying densities of shrubs such as *Lebeckia spinescens, Phaeoptilum spinosum, Rhigozum trichotomum, Gnidia polycephala and Lycium pumilium.* Within some areas, the density of *Rhigozum trichotomum* is very high, suggesting that these areas are to some extent, degraded as a result of overgrazing. This is not a highly sensitive plant community, as the diversity is quite low and it occurs largely on flat and gently sloping areas. It does however, tend to occur in proximity to drainage lines. In some parts of the site, this vegetation type and the calcrete shrubland, grade slowly into one another. There are extensive areas of shallow soils overlying calcrete, which are comprised of a mix of shrubs and grasses. These areas were mapped as a separate unit in Figure 6.4 as Mixed Shrubland. This area represents the transition area between the two aforementioned vegetation types.

Figure 6.5: Examples of the sandy Lowlands vegetation type at the site.

» *Calcrete Plains Shrubland:* The Calcrete Plains vegetation unit occurs in areas of shallow soils overlying calcrete, often with the calcrete exposed. This vegetation unit is broadly equivalent to the Bushmanland Basin Shrubland vegetation type of Mucina & Rutherford (2006). This is a low open shrubland with few trees. Dominant species include *Pteronia sordida*, *Pteronia glomerata*, *Rosenia humilis*, *Pentzia incana*, *Stipgrostis obtusa*, *Enneapogon desvauxii*,

Plinthus karooicus and *Lycium cinereum*. This is not considered to be a sensitive plant community, as the plant diversity is quite low and it occurs on gently sloping plains where the risk of secondary impact such as erosion is low. This community is particularly prominent in the eastern part of the site, where a large proportion of the turbines are to be located.

Figure 6.6: Examples of the sandy Lowlands vegetation type at the site

» *Quartzitic Hills Bushveld*: The majority of the rocky hills within the site are quartzitic in nature and contain a greater amount of large woody species compared to the other communities at the site. This vegetation type is similar to the Lower Gariep Broken Veld of Mucina and Rutherford (2006). Dominant woody species include trees such as *Acacia mellifera*, Boscia albitrunca and Rhus burchellii and shrubs such as *Hermannia desertorum*, *Aptosimum spinescens*, *Sericocoma avolans*, *Asparagus capensis* and *Rhigozum trichotomum*. Dominant grass species include *Digitaria eriantha*, *Oropetium capense*, *Heteropogon contortus* and *Aristida diffusa* subsp. *burkei*. This is a diverse community and contains much higher species richness than the other plant communities at the site. In addition, the rocky areas also provide habitat for reptiles and small mammals that is not available elsewhere at the site. Due to the higher plant and faunal diversity of the rocky hills, they are considered more sensitive than the surrounding communities. Species of conservation significance which were observed in this community include: *Boscia albitrunca, Pachypodium succulentum, Lithops* spp.

Figure 6.7: Examples of the Quartzitic Hills vegetation unit

» *Drainage Lines*: The drainage lines at the site were generally poorly developed on account of the fact that the site is towards the top of the catchment, and there were no drainage lines at the site which received runoff from a very large area. , The deep sands present in the sandy lowlands have a high infiltration capacity and there was little runoff from these areas. Drainage lines which enter these areas from the rocky hills were often dissipated by the sandy substrate. The drainage lines themselves were usually characterised by the presence of woody species such as *Acacia mellifera*, *Boscia albitrunca*, *Ehretia rigida*, *Lycium oxycarpum* and *Phaeoptilum spinosum*. As drainage lines are important for fauna as well as perform an important ecological role in regulating runoff, they should be avoided wherever possible.

Listed Plant species

Only two listed plant species are known from the area, *Hoodia gordonii* which is listed as DDD (data deficient, insufficient information) and *Salsola apiciflora* which is listed DDT (Data Deficient – Taxonomically Problematic). Neither of these species were observed at the site and although *Hoodia gordonii* may be present, this species is widespread across the karoo and Kalahari and is not of significant conservation concern. As *Hoodia gordonii* is usually quite conspicuous it is not likely that it occurs at the site and if it does then it is certainly not abundant.

Other species of conservation concern that were observed at the site includes *Boscia albitrunca* which was common across the site. This species is however widely distributed and is not rare and the loss of some individuals from the development footprint would not compromise the local population of this species. A few notable edaphic specialists were observed at the site such as *Titanopsis calcarea* which is restricted to areas of exposed calcrete gravel and *Lithops hallii* which was observed on several of the quartzitic hills at the site. Both these species are currently listed as Least Concern, but as they are edaphic specialists they should be avoided where possible. A number of other species protected under provincial legislation were also observed at the site including *Pachypodium succulentum*, *Mestoklema tuberosum*, *Tritonia laxifolia*, *Aloe claviflora* and *Avonia ustulata*. None of these species are very rare and most of them are suitable candidates for search and rescue and so any affected individuals within the development footprint could be translocated to safety.

Terrestrial Mammals

The site falls within the distribution range of 43 terrestrial mammal species, indicating that the potentially has quite high mammalian diversity. Species that were observed at the site include Cape Porcupine *Hystrix africaeaustralis*, Steenbok *Raphicerus campestris*, Aardvark *Orycteropus afer*, Rock Hyrax *Procavia capensis*, Cape Hare *Lepus capensis*, South African Ground Squirrel *Xerus inauris*, Namaqua Rock Mouse *Aethomys namaquensis*, Yellow Mongoose *Cynictis penicillata* and Striped Polecat *Ictonyx striatus*. Although the site contains a variety of habitats, it does not contain any perennial water sources or significant rocky outcrops. The rocky slopes at the site consist of loose boulders and stones and there are very few areas with significant crevices and shelter sites within rock faces or boulder piles. As a result species associated with such habitats are not likely to be common at the site. For example, Rock Hyrax were only observed along the Eskom power line which traverses the site, in an area where boulder piles had been created by ground clearing during construction.

Two species of conservation concern may occur at the site, the Black-footed cat *Felis nigripes* (Vulnerable) and the Honey Badger *Mellivora capensis* (SA RDB Endangered). However as both these species are widely distributed across the arid and semi-arid areas of South Africa, the development would not amount to a significant amount of habitat loss for these two species. The construction phase of the development would generate a lot of noise and disturbance which would deter many larger mammals from the area. During the operational phase, however, the levels of disturbance will be significantly lower and disturbed species or individuals are likely to return to the site. Initially, some mammals may be wary of the turbines, but are likely to become habituated to their presence.

Reptiles

The site falls within the distribution of range of 39 reptile species and an additional four species have been recorded from the area by SARCA, which are outside of their published distribution range. The reptile community composition of the site is likely to be very high in lizards and skinks relative to snakes and other groups. Species observed during the site visit include the Variegated Skink *Mabuya variegata*, Karoo Girdled Lizard *Cordylus polyzonus*, Ground Agama *Agama aculeata*, Spotted Sand Lizard *Pedioplanis lineoocellata* and Namaqua Sand Lizard *Pedioplanis namaquensis*. No listed reptiles are known from the area. Although the rocky hills are likely to contain greater reptile species richness than other habitats, there are no specific habitats at the site which are particularly important for reptiles. As a result, impacts on reptiles are likely to result largely from habitat loss and the disruption of landscape connectivity, rather than a specific threat to any rare or unique reptile habitats. Many reptiles are vulnerable to predation when traversing open areas and the presence of the roads will result in increased predation risk for susceptible reptiles. The overall impact on reptiles is however not likely to be highly significant. The total amount of habitat loss is not very large, the surrounding landscape is overwhelmingly intact and no rare or restricted reptile habitats would be affected by the development.

Amphibians

The site lies within the distribution range of 10 frog species. Of these, only the Giant Bullfrog *Pyxicephalus adspersus* is of conservation concern and is listed as Near Threatened. This species is associated with temporary pans and as there were no temporary or permanent water bodies within the site, it is not likely that it is an important area for the Giant Bullfrog. In terms of the other species which may occur at the site, only those species which are able to survive away from permanent water are likely to occur at the site. Given the paucity of temporary or permanent water at the site, it is not likely to have a very diverse amphibian population and impacts on amphibians are not likely to be of much consequence. The greatest threat to amphibians associated with the development is probably chemical and fuel/oil spills related to the construction activities, rather than the presence of the development in the long-term. It is not likely that the development of the facility would have a significant long-term impact on local amphibian populations.

Bats

Based on historically recorded and modelled distributions by Friedmann and Daly 2004 and Monadjem et al. 2010 there are 12 bat species with the potential to occur in the study. Of the 12 species identified as potentially occurring in the study area one is Vulnerable, three Near threatened, seven Least Concern and one Data

Deficient. Seven of the identified species are considered highly likely to occur in the study area, two considered moderately likely and three are unlikely but possible to occur. A detailed list is given below:

Vulnerable:

- Percival's Short-eared *Trident Bat Cleotis percivali*

Near Threatened

- African Straw-coloured Fruit Bat *Eidolon helvum*
- Natal Long-fingered Bat *Miniopterus natalensis*
- Angolan Wing-gland Bat *Cistugo seabrae*

Least Concern

- Geoffroy's Horseshoe *Rhinolophus clivosus*
- Darling's Horseshoe Bat *Rhinolophus darling*
- Egyptian Slit-faced Bat *Nycteris thebaica*
- Egyptian Free-tailed Bat *Tadarida aegyptiaca*
- Long-tailed Serotine *Eptesicus hottentotus*
- Temminck's Myotis *Myotis tricolor*
- Cape Serotine *Neoromicia capensis*

Data Deficient

- T Dent's Horseshoe Bat *Rhinolophus denti*

During the site visit conducted by the specialist no activity was recorded on Nelspoortjie farm itself, but preliminary results indicate high activity at the abandoned Copperton Mine and the Nelspoortjie homestead and moderate activity in the town of Copperton. The following species were identified in transects in these areas:

- Cape Serotine *Neoromicia capensis*
- Long-tailed Serotine *Eptesicus hottentotus*
- Natal Long-fingered Bat *Miniopterus natalensis*
- Egyptian Free-tailed Bat *Tadarida aegyptiaca*

Avifauna

The site falls within Bushmanland Arid Grassland vegetation type. To the south west of the site is the "Bushmanland Basin Shrubland" vegetation type, and to the north east is "Lower Gariep Broken Veld". This distribution of vegetation is relevant to avifauna in that the site is composed of short karoo type veld, with grassy components. This affects the species likely to occur on site, and is reflected in the data in Table 6.1 below, which shows that most of the Red Listed bird species

recorded by the Southern African Bird Atlas Project (Harrison et al, 1997) in the area favour short open vegetation types such as these ones.

Avian microhabitats

The above vegetation description partially describes the habitat available and hence the species likely to occur in the study area. More detail is however required in order to understand exactly where within the study area certain species will occur and how suitable these areas are for the relevant species. The habitats available to birds at a small spatial scale are known as micro habitats. These micro habitats are formed by a combination of factors such as vegetation, land use, anthropogenic factors, topography and others.

These micro habitats are critically important in mapping the site in terms of avifaunal sensitivity and ultimately siting the proposed turbines within the affected farms. The micro habitats that the Red Listed species are most likely to use are shown in Table 6.1. The micro habitats on site include: karoo type shrubland, minor drainage lines and slight ridges. Although several slightly different micro habitats (based on appearance to us) exist on site, these are essentially all karoo type habitats. Several small dams exist on or near site, as well as several windmills with reservoirs. These areas provide more moisture than the surrounds and hence have slightly different vegetation and avifauna.

Target species for this study

Based on species like to occur on site (Table 6.1) and review of other relevant information sources the target species[5] for the study site was determined. The resultant list of 'target species' for this study are as follows: Lesser Kestrel *Falco naumanni*; Kori Bustard *Ardeotis kori*; Ludwig's Bustard *Neotis ludwigii*; Secretarybird *Sagittarius serpentarius*; Lanner Falcon *Falco biarmicus*; Cape Long-billed Lark *Certhilauda brevirostris*; White Stork *Ciconia ciconia*; Jackal Buzzard *Buteo rufofuscus*; Black-shouldered Kite *Elanus caeruleus*; Rock Kestrel *Falco rupicolus*; Greater Kestrel *Falco rupicoloides*; Southern Pale Chanting Goshawk; Karoo Korhaan *Eupodotis vigorsii*; Northern Black Korhaan *Afrotis afraoides*; and Namaqua Sandgrouse *Pterocles namaqua*. It must be stressed that at this stage this list is preliminary and is being confirmed by pre-construction bird monitoring that is being conducted on the site.

Sightings of target and relevant species by avifaunal specialist during the EIA phase site visit are shown in Figure 6.8 (all recorded species shown in Appendix 2 of the Avifauna Specialist Report in Appendix G). The most commonly sighted species were korhaans, both Northern Black *Afrotis afraoides* and Karoo Korhaan *Eupodotis vigorsii*. Only one sighting of a single Ludwig's Bustard was made, and a pair of

[5]Target species refers to the most important species to be considered in the impact assessment

Kori Bustard was also seen. The only raptors seen were Greater Kestrel *Falco rupicoloides* and Southern Pale Chanting Goshawk *Melierax canorus*.

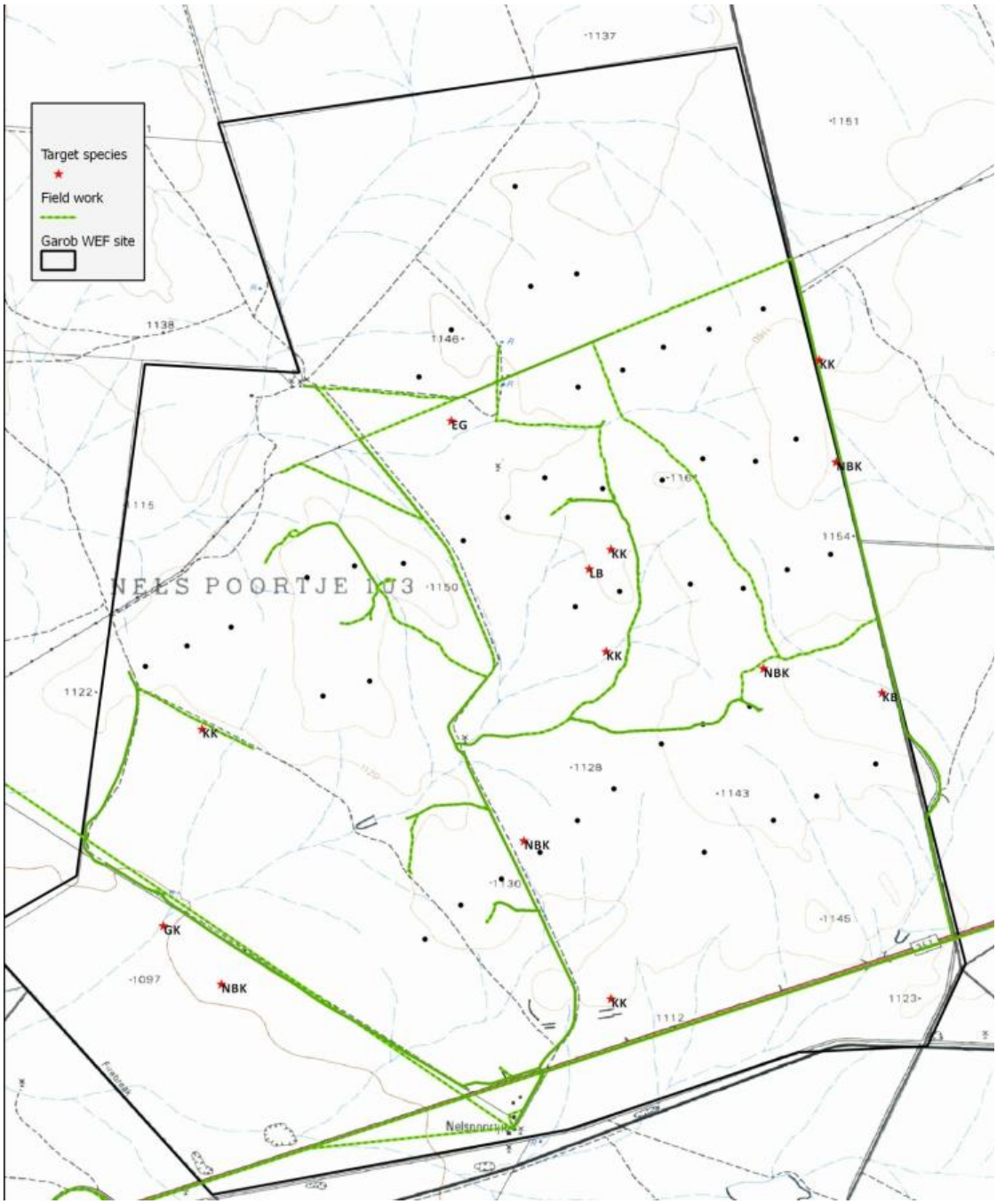


Figure 6.8: Target species sightings during field work. KK = Karoo Korhaan; NBK = Northern Black Korhaan; LB = Ludwig's Bustard; KB = Kori Bustard; GK = Greater Kestrel; EG = Egyptian Goose.

Table 6.1: Red Listed species recorded in the four quarter degree squares considered relevant (2922CD, 2922CC, 2922DC, & 3022AB) during the Southern African Bird Atlas Project (Harrison et al, 1997).

Roberts #	Common Name	*Scientific Name*	Conservation status	Preferred micro habitat	Likelihood of occurring on site	Relative importance of site for national population of species	Likely interactions with proposed facility
183	Lesser Kestrel	*Falco naumanni*	V	Karoo shrubland, grassland	Probable	Low	Collision, disturbance, habitat destruction
230	Kori Bustard	*Ardeotis kori*	V	Karoo shrubland, grassland, woodland	Possible	Low	Collision, disturbance, habitat destruction
232	Ludwig's Bustard	*Neotis ludwigii*	V	Karoo shrubland, grassland	Possible	Low	Collision, disturbance, habitat destruction
84	Black Stork	*Ciconia nigra*	NT	Riverine, cliff	Unlikely	Low	Collision
96	Greater Flamingo	*Phoenicopterus ruber*	NT	Dam, pan, floodplain	Unlikely – could overfly	Low	Collision
118	Secretarybird	*Sagittarius serpentarius*	NT	Karoo shrubland, grassland, woodland	Possible	Low – unless breeding on site	Collision, disturbance, habitat destruction
172	Lanner Falcon	*Falco biarmicus*	NT	Karoo shrubland, grassland	Possible	Low – unless breeding on site	Collision, disturbance, habitat destruction
500	Cape Long-billed Lark	*Certhilauda curvirostris*	NT	Karoo shrubland, grassland	Possible	Low	Disturbance, habitat destruction
510	Sclater's Lark	*Spizocorys sclateri*	NT	Karoo shrubland, grassland	Possible	Low	Disturbance, habitat destruction
83	White Stork	*Ciconia ciconia*	BONN	Grassland, arable land, wetland, dam, karoo shrubland	Possible	Low	Collision, electrocution

V = Vulnerable; NT = Near-threatened; Bonn = Protected under the Bonn Convention on migratory species.

6.4. Social Characteristics of the Study Area and Surrounds

6.4.1 Economy

The proposed Garob Wind Farm site is located in the sparsely populated, arid Karoo region, approximately 10 km east of the small former mining town of Copperton, within the Siyathemba Local Municipality. The main land uses in the study area are linked to extensive agriculture (stock farming), mining and game farming.

Livestock farming accounts for ~98.7% of agricultural land use and ~75% of the Siyathemba Local Municipality's agricultural GDP. At least 12 major crop types are cultivated in the Gariep Valley (mainly east of Prieska), the most important of which are maize and wheat, peanuts, lucerne (alfalfa) and table grapes. Stock farming operations are mainly based on small stock (sheep, goats) on spatially extensive commercial farms. Both wool and carcasses are produced. Game farming (hunting) is emerging as a key diversification strategy.

The mining sector historically played a major role in the local economy, with asbestos and copper/ silver (Copperton) mining the key activities. The closure of asbestos mines (mainly to the north of Prieska) as well as the Copperton mine (~10 km west of the Garob site) around the early 1990's has had a major lasting negative impact on the Siyathemba Local Municipality economy. Former mining towns (like Copperton) have dwindled to virtual ghost towns. The Copperton community is very isolated from employment opportunities and amenities. The lack of water poses a significant constraint to development of the Copperton area.

The Siyathemba Local Municipality tourism industry is in a fledgling stage, and largely based around the Gariep Valley, and specifically the town of Prieska. The R357 (Van Wyksvlei to Prieska, via Copperton and the proposed Garob site) has been proposed as a scenic drive with touristic potential within the 2006 Pixley ka Seme District Municipality SDF.

6.4.2 Population

The total population of the Pixley ka Seme District Municipality is ~165 000 (Census 2001). Of the total population Coloureds make up ~62% of the total, followed by Black Africans (~27%) and Whites (~10%). For the Siyathemba Local Municipality, the figures are ~64% Coloured, 26% Black African and 8% Whites. The Siyathemba Local Municipality makes up ~22% (36 000) of the total, making it the most populated local municipality in the district municipality. The demographic makeup of the Siyathemba Local Municipality is similar to that of the region. The population density for the region is 2.1 people per square kilometre. In terms of future growth projections, a negative growth rate is forecast for the rural population

and by 2015 the towns are also expected to show a negative growth rate 0f 1.29% (Pixley ka Seme District Municipality IDP).

6.4.3 Education

Based on Census 2001 data, ~25% of the Pixley ka Seme District Municipality population had no education, while 35% only had primary level of qualifications. The figures are essentially the same for the Siyathemba Local Municipality. The education levels in the region are low and can be attributed to the rural nature of the area together with the substantial number of previously disadvantaged population groups who did not have equal access to education in the past era.

According to the Municipal Profiles of 2002, the primary school population represented 46.3% of the total population of the district. There are 49 primary schools and 18 secondary schools and combined schools in the district. While the actual number of schools is generally satisfactory there is an acute shortage of schools in the remote areas of the district. As a result children often have to walk long distances to reach schools (Pixley ka Seme District Municipality IDP 2008/2009).

6.4.4 Employment levels

According to the Census 2001 data the unemployment rate in the Pixley ka Seme District Municipality was 21%[6]. The rate for the Siyathemba Local Municipality was 14%. In terms of employment the agricultural sector was the most important economic sector in the Pixley ka Seme District Municipality accounting for ~39% of the total working population. The commercial services sector accounted for ~23% of the employment opportunities. These two sectors combined therefore accounted for ~62% of all the employment opportunities in the area.

6.4.5. Noise receptors

Wind turbines emit noises at sufficient levels to propagate over some distance. There will be a number of wind turbines operating simultaneously in an area where there are noise-sensitive developments which increases the possibility that a noise impact could occur.

Three potential noise-sensitive developments (NSD) were identified in the area (within the site proposed, as well as potential NSDs up to 2 km from the boundary of the facility). These NSDs are illustrated in Figure 6.9 below.

[6] A more recent estimate indicated an unemployment rate of 37% (Pixley ka Seme District Municipality IDP 2010/ 2011).

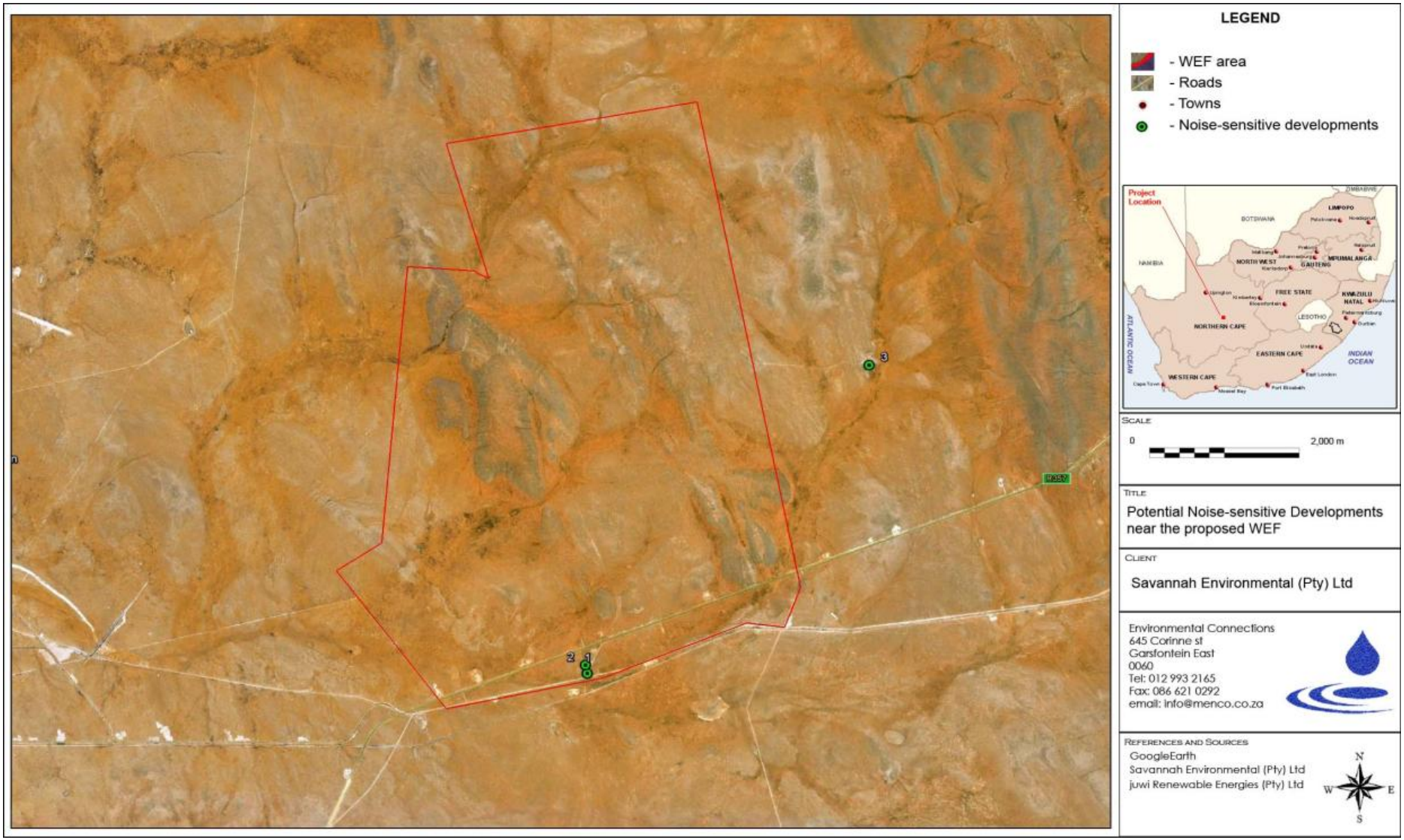


Figure 6.9: Potential Noise Sensitive Developments near the proposed site

6.4.6. Heritage and Palaeontological Profile

The site lies on a featureless flat plain with relatively low vegetation. Other studies in the area, have highlighted the archaeological importance of pans (Kiberd 2006, Wiltshire 2011, Orton 2012). No pans are however present within the study area, although ancient pans might be buried underneath the aeolian sands and the possibility of finding important subsurface material cannot be excluded. Low densities of Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) scatters were found across the site and are of low archaeological significance, some of these were documented as find spots. However, several discrete MSA and LSA sites were found and documented as sites. A single stone enclosure was also found as well as several sites with historic material. The site has been included in the NO-GO zones for the wind farm and a no development buffer of 100m around the kraal will suffice to protect the site.

MSA artefacts consisted of large flakes, radial and bipolar cores, points, end scrapers, large utilized and retouched blade tools, and utilized and retouched flakes. Raw materials were predominant in fine grained quartzite, hornfels, banded ironstone, chert and vein quartz. Localised Stone Age quarries exploiting the quartzitic bedrock and boulders of vein quartz were also found.

LSA tools were found in comparatively fewer concentrations as compared to the MSA tallies. LSA tools consisted of chert, hornfels and other indurated shales, banded ironstone, vein quartz and quartzites. Adzes, scrapers, retouched and utilized flakes, bladelets, small round cores, and unmodified flakes and chunks were seen and this was also noted by Kaplan (2010) to the south-east of Copperton mine and just east of the current study area on Vogelstruisfontein by Wiltshire (2011).

Small numbers of isolated weathered ESA scatters were documented with a number of bifaces (handaxes) made from quartzite. No buildings exist on the site and no cultural landscape elements were noted. Visual impacts to scenic routes and sense of place are slightly higher due to the projects close proximity to the road but are still not assessed to be high.

From a palaeontological point of view the site occurs in an area that contains Precambrian metamorphic rocks which do not contain fossils, Permo-Carboniferous Dwyka deposits of the Mbizane Formation and Quaternary deposits belonging to the Gordonia Formation. The Dwyka deposits comprise a very small portion of the site and rarely contain fossils. Fossils recovered from Quaternary deposits are almost always found in caves or in the banks of steep-sided river gulleys.

The low-lying relief and absence of potentially fossiliferous gulleys on the site strongly suggest that fossils are absent from this site.

ASSESSMENT OF POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED GAROB WIND FARM CHAPTER 7

This chapter serves to determine the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) associated with the development of the proposed **Garob Wind Farm** and associated infrastructure.

Infrastructure associated with the wind energy facility is proposed to include:

» 58 **wind turbines** with a hub height of up to 100m and a rotor diameter of up to 120m. The facility will have a total generating capacity of up to 140 MW.
» Concrete **foundations** to support the turbines.
» **Cabling** between the turbines, to be laid underground where practical so to connect to the on-site substation.
» Internal **access roads** to each turbine (approximately 7 m wide) linking the wind turbines and other infrastructure on the site. Existing roads will be used as far as possible.
» Workshop area / office for control, maintenance and storage.
» An on-site substation to facilitate the connection between the wind energy facility and the electricity grid.
» New 132 kV overhead power line. Two options are being considered as follows (see also Figure 1.1 below) :
  * **Option 1:** Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
  * **Option 2:** would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
    o **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
    o **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

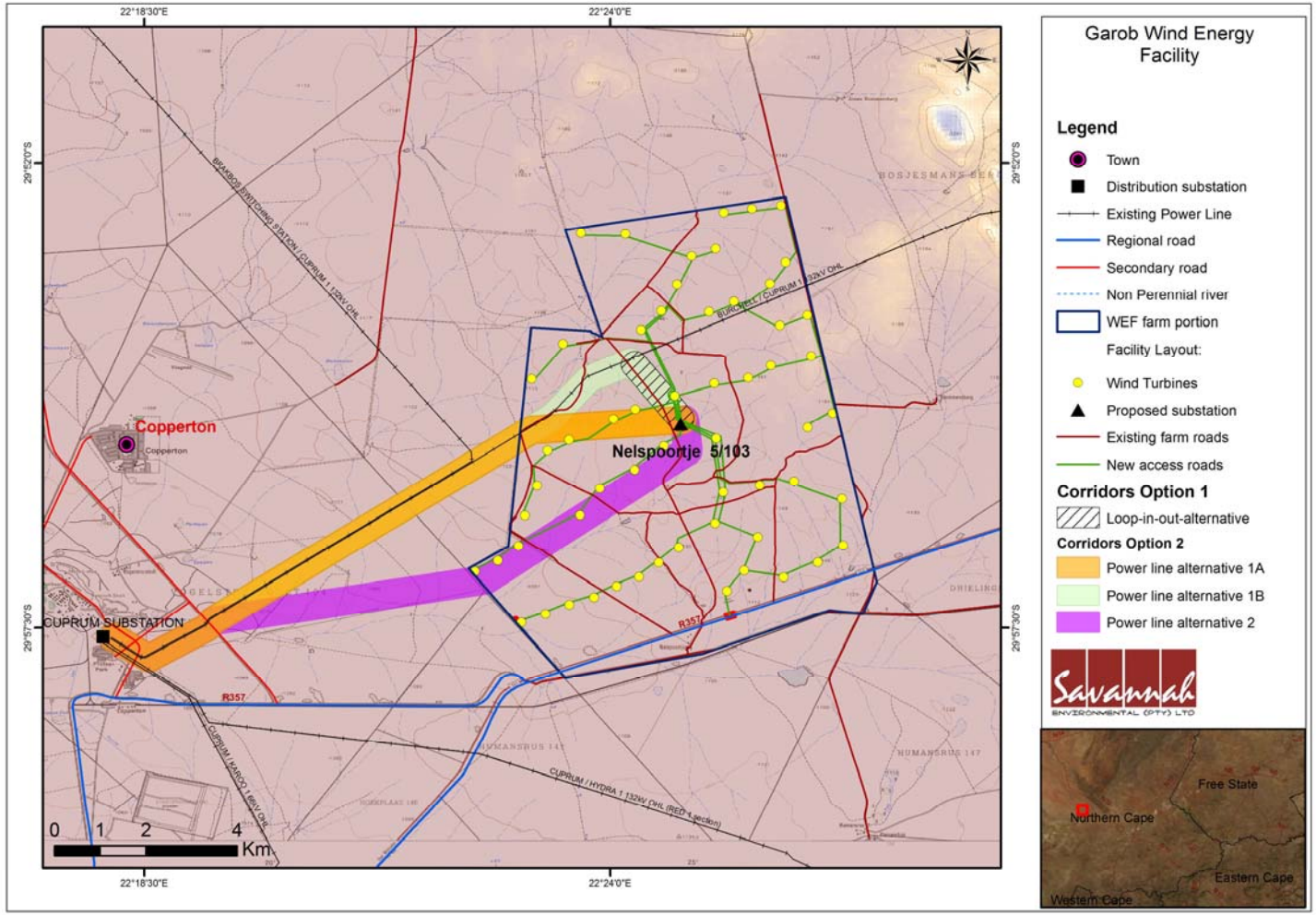


Figure 7.1: Preliminary layout showing the study area as well as proposed infrastructure for the Garob Wind Farm located on portion 5 of the farm Nelspoortje 103, within the Siyathemba Local Municipality (Northern Cape)

The establishment of a renewable energy facility project is comprised of several phases, including pre-construction, construction, operation, and decommissioning. The **construction activities** involved for the proposed facility will include the following:

» Conduct pre-construction surveys
» Establishment of access roads within the site
» Undertaking site preparation (i.e. including clearance of vegetation; and stripping of topsoil)
» Establishment of laydown areas on site
» Construction of foundations for wind turbines
» Transportation of components and equipment to site
» Assembly of wind turbines
» Construction of the on-site substations
» Connection of the components (wind turbines) to the on-site substations
» Connection of the on-site substations to the Eskom grid
» Undertake site rehabilitation

The **operational activities** will include the following:

» The operation of the wind turbines and associated infrastructure
» Site operation and maintenance

The **decommissioning activities** will include the following:

» Removal of project infrastructure
» Site rehabilitation

The construction and decommissioning activities have the potential to impact on the receiving environment in terms of habitat destruction, disturbance, and alteration; impacts on biodiversity; threatened fauna and flora species; and ecological processes; soil degradation; erosion; and increased erosion potential; impacts on heritage sites; and impacts on the visual aesthetics.

Environmental issues specific to the operation phase of a wind energy facility include, amongst others, visual impacts through the visual dominance of the wind turbines within the landscape; avian mortality through collisions/electrocutions with the power lines and turbines; and low frequency noise associated with rotation of the blades.

These and other environmental issues were identified through a scoping evaluation of the proposed facility. Potentially significant impacts have now been assessed during this EIA Phase. This EIA process has involved key input from specialist

consultants, the project developer, and from key stakeholders and interested and affected parties. The significance of impacts associated with a facility of this nature is always project specific, and therefore impacts may vary significantly between facilities.

This chapter serves to assess the identified potentially significant environmental impacts associated with the development of the proposed facility, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Plan (Refer to Appendix O).

7.1. Assessment of Alternatives

In accordance with the requirements of the EIA Regulations[7], alternatives are required to be considered within the EIA process, and may refer to any of the following:

» Site alternatives
» Activity alternatives
» Design or layout alternatives
» Technology alternatives
» Operating alternatives
» No-go alternative

7.1.1 Site Alternatives

Through the regional assessment site identification and selection process, juwi on behalf of Garob Wind Farm (Pty) Limited were guided to site/locate their proposed wind farm within an area/zone of preference (the site selection process undertaken was described in detail in Chapter 4 of the Scoping Report). The regional site assessment involved testing the site against environmental and planning criteria. This approach served as a site risk assessment tool from an environmental acceptability perspective – that is, a process to highlight or red-flag potential issues of concern prior to initiating a full EIA process for a proposed site. Therefore no location/site alternatives have been considered further.

7.1.2. Activity Alternatives

No activity alternatives were assessed since the site has been identified by Garob Wind Farm (Pty) Limited as being highly desirable for the establishment of a wind energy generating facility and not any other development or renewable technologies such as photovoltaic solar (PV) or concentrated solar power (CSP).

[7] GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity.

This is due to the favourable wind resource associated with the proposed site. In addition, Garob Wind Farm (Pty) Limited as a wind farm developer has technical expertise to develop wind farms and not other renewable technologies.

Therefore, a wind facility is considered by Garob Wind Farm (Pty) Limited to be the only feasible and reasonable activity for their consideration on the proposed site.

7.1.3 Design or layout alternatives

A preliminary wind turbine layout has been compiled 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 Garob Wind Farm, (as shown in **Figure 7.1**). This layout is considered to be highly accurate (90%) but still allows for some adjustment to avoid site-specific environmental constraints, 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 provided by the developer 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 and internal substation site.

Planning and design for the transmission of the power generated at the wind energy facility is being undertaken. This has been informed through understanding the local power requirements and the stability of the local electricity network.

Layout alternatives assessed in the EIA phase include:

» Two options for grid connection (power line routes)

These options are shown in **Figure 7.1**, are described below and assessed in the sections that follow.

Two options for grid connection (power line routes)

» **Option 1:** Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
» **Option 2:** would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
  - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing

the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)

- **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

7.1.4. Technology alternatives

This refers to alternative technologies for use in the establishment of the wind energy facility. There is a limited range of alternative technologies (turbines) for commercial-scale wind energy facilities. In addition, the technology is constantly evolving. Table 7.1 summarises the types of variables associated with existing wind turbine technologies. There are no significant differences from an environmental perspective between technologies. The technology provider has not yet been confirmed and will be decided after further wind analysis and a tender process. Note that Garob Wind Farm (Pty) Limited would utilise the same make and model (and size) of turbine across the whole site.

Table 7.1: Variables associated with existing wind turbine technologies

Variables	Description
Type	The horizontal axis wind turbine completely dominates the commercial scale wind turbine market.
Size	Typical land-based utility scale wind turbines are in the 600 kW to 3 MW range.
Foundation	The foundation is usually poured concrete. Its size and shape is dictated by the size of the wind turbine and geotechnical considerations.
Tower	Towers are typically constructed from steel and/or concrete. The height of towers generally varies between 80 m and 140 m.
Rotor	3- bladed rotor is the general standard but there are also 2 blade turbine which are less common.
Rotor Speed Control	Fixed or variable speed rotors.
Gears	Geared and Gearless.
Generator	Standard high speed generator (geared) or custom low-speed ring generator (gearless).
Other variables	Yaw gears, brakes, control systems, lubrication systems and all other turbine components are similar on modern wind turbines.

7.1.5. Operating alternatives

This refers to the manner in which a proposed facility would function. No operational alternatives were assessed as no feasible and reasonable operational alternatives were identified.

7.1.6. The 'do nothing' alternative

The 'do-nothing' alternative is the option of not constructing the Garob Wind Farm on the proposed site. Two main reasons why the do-nothing alternative is not preferred in relation to this wind energy facility project are discussed below, namely:

» The current land-use regime of the site; and
» The need to diversify the energy mix in South Africa.

The agricultural potential of the site is relatively poor and is limited to extensive grazing due to the very low rainfall. There is no identified agriculturally important infrastructure, i.e. (i.e. silos, irrigation lines, pivot points, channels and feeding structures, etc.) or any conservation works (i.e. contour banks, waterways, etc.) located on the site. The "do nothing" alternative would result in the maintenance of current land-use and livestock grazing, with a resultant loss of opportunity to generate renewable energy from the wind and simultaneously continue current livestock grazing on areas that fall outside of the proposed wind energy facility infrastructure. This is considered to be an overall negative impact at a local and national level. Therefore, from a land-use perspective, the do nothing alternative is not preferred.

In addition, 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 detail in the South Africa Renewable Energy Feed-in Tariff (REFIT) Regulatory Guideline published by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can

often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» **Resource saving:** Conventional coal fired plants are 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 release of by-products of fossil fuel burning for electricity generation has 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.

In order to meet the long-term goal of a sustainable renewable energy industry, 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. This is however dependent on the assumed learning rates and associated cost reductions for renewable options.

Through feasibility studies undertaken by the project proponent, the viability of the Garob Wind Energy Facility has been established, and Garob Wind Farm (Pty) Limited proposes that up to 58 turbines 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 Northern 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, since if the wind energy facility is not developed 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.

7.2. Areas of disturbance associated with the proposed Garob Wind Farm

In order to assess the impacts associated with the proposed renewable energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the footprint of the turbines, substations and associated access roads. A study area of approximately 5 520 ha is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by the turbines and associated infrastructure is illustrated in Figure 7.1.

7.2.1. Permanently affected areas on site

From the results of the facility layout determination, it is apparent that the effective utilised area within the site is only approximately 308 523m^2 in extent. This amounts to 0.6 % of the total 5 520 ha originally earmarked for development, and is broken down in the table below.

Permanently affected areas within the farm boundaries are summarised as follows.

Facility component –permanent	**Approximate extent (in m^2)**
58 turbine footprints (i.e. each 26 m^2)	1 508
Permanent access roads underlain with cabling where possible (7 m wide and 42.145 km long)	295015
Substation footprint	12 000
TOTAL (m^2)	**308523 m^2** (of a total area of 55 200 000 m^2) **~ 0.6 % of site**

The permanent area lost to the proposed renewable energy facility will therefore amount to >0.6 % of the total 5 520 ha of the broader site. Most of the existing access roads will be used to access the site.

7.2.2. Temporarily affected areas on site

Temporarily affected areas comprise laydown areas for turbines (i.e. each with a minimum footprint of 52 m^2 per turbine). The underground cabling to connect the turbines to the on-site substations will make use of the permanent access roads to be constructed on site. A trench of approximately 1 m deep will be excavated in which the cabling will be laid; thereafter the area will be rehabilitated.

Facility component –temporary	**Approximate extent (in m^2)**
Laydown areas for turbines (i.e. each 52 m^2)	3 016
Internal access roads during construction	295015
TOTAL (m^2)	**298 031 m^2** (of a total area of 55 200 000m^2) **~ 0.5 % of site**

Temporarily affected areas of the proposed wind energy facility will amount to ~0.5 % of the total 5 520 ha of the broader site.

7.3. Assessment of the Potential Impacts associated with the Construction and Operation Phases of the Garob Wind Farm

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation of the proposed renewable energy facility. Issues were assessed in terms of the criteria detailed in Chapter 4. The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted.

7.3.1 Assessment of Potential Impacts on Ecology

Major potential impacts on the ecology of the proposed study area are described briefly below. There are two major ways that a wind energy development may impact on the ecological environment: a) through direct impacts on individual organisms and b) through impacts on habitat structure and functioning.

Areas of potentially high sensitivity are shown in Figure 7.2. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Broad scale mapping, desktop assessments, detailed mapping from aerial photography and detailed fieldwork were used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. Perennial and non-perennial rivers, streams and drainage lines: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
2. The presence of quartzitic rocky hills at the site which contained relatively greater species richness of fauna and flora as compared to the adjacent habitats on sandy soils or calcrete).

The drainage lines are the only feature at the site which are considered to be of Very High sensitivity. No turbines should be located within such areas, but is may be necessary for roads and other infrastructure to traverse these areas. In such situations, measures should be taken to ensure that the natural flow of water is not

disrupted or diverted by the infrastructure and that the development footprint is kept to a minimum.

The quartzitic hills are considered to be High sensitivity on account of the higher flora and fauna richness associated with these areas. However, there were few threatened species present even within this habitat and with appropriate avoidance and mitigation measures the impacts to the rocky hills could be significantly reduced. The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas. In addition, it is recommended that on the steeper slopes the roads follow less direct routes with lower erosion risk or contain switchbacks which reduce the slope angle and limit the slope length that water would travel before leaving the road.

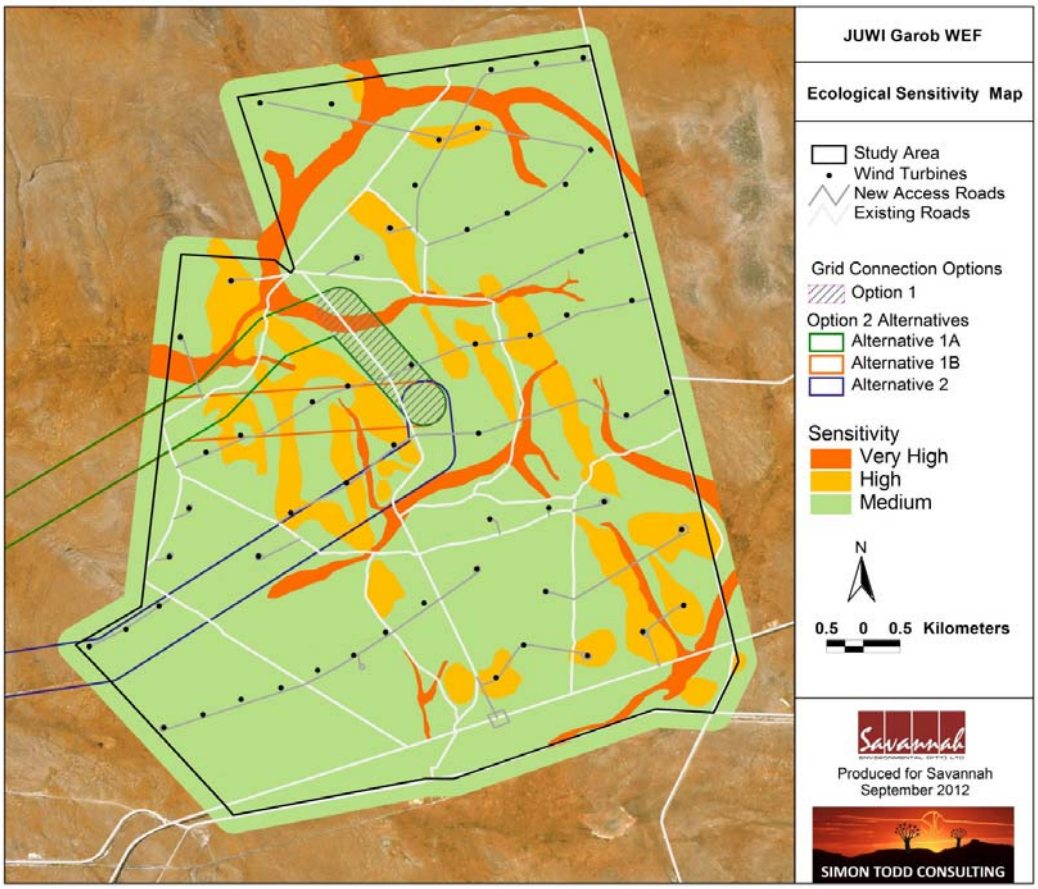


Figure 7.2: Map indicating the sensitive ecological areas in the study area

Impact table summarising the significance of impacts on the ecology of the site (with and without mitigation)

The following tables summarise the potential impacts associated with the construction and operation of the wind component of the facility.

Nature: Impacts on vegetation and protected plant species during construction of the facility

Some loss of vegetation is an inevitable consequence of the development. Although there are not many red-data listed plant species at the site, there is a reasonably large number of protected species present. The potential impact of the development on protected plant species and sensitive vegetation units is a potential concern with regards to the development of the site.

	Without mitigation	**With mitigation**
Extent	local (2)	local (2)
Duration	Long term (4)	Long term (2)
Magnitude	Medium (6)	low (4)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium - High (60)**	**Medium (32)**
Status (positive or negative)	negative	negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To a large extent	

Mitigation:

» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» Where roads and other infrastructure cross sensitive features such as drainage lines and/or quartzitic hills, caution should be exercised to ensure that impact to these features are minimised.
» The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction.
» Development would be likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion should be implemented as part of the EMP for the development.

Cumulative impacts:

The potential for cumulative impacts is quite low on account of the small development footprint of the facility in relation to the overwhelmingly intact nature of the surrounding landscape.

Residual Impacts:

Some loss of vegetation is inevitable and cannot be avoided.

Nature: Increased alien plant invasion as a result of disturbance created during construction

Disturbance created at the site during construction would leave the site vulnerable to alien plant invasion. Many of the sandy areas were already invaded to some extent by *Prosopis*

and the presence of this species across the site, will increase the risk that it will spread and increase in abundance at the site. The disturbance created at the site would also encourage the invasion of other species, some of which may also be transported onto the site on dirty machinery or construction materials brought onto the site.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	long-term (4)	Short-term (1)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**low (15)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Cleared areas which are not surfaced or required for construction should be revegetated with seed or plants of locally occurring species.
» Regular monitoring for alien plants within the development footprint.
» Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
» Alien management plan should be developed as part of the EMP for the development, it should aim to address alien plant problems within the whole site, not just the development footprint

Cumulative impacts:

If alien abundance, particularly *Prosopis* increases a lot then some impact on hydrology and the ecological functioning the area can be expected.

Residual Impacts:

If alien species at the site are controlled, then there will be very little residual impact

Nature: Habitat loss for fauna.

The development of the wind energy facility will result in the transformation and/or loss of habitat for resident fauna. This potentially includes two listed mammals and a single listed amphibian. In terms of a direct loss of habitat, the development of the wind energy facility would result in the loss of approximately 34 ha of currently intact vegetation.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (55)**	**Low (36)**
Status (positive or negative)	negative	negative
Reversibility	Low	Low

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree, but not entirely	
Mitigation: » Vegetation clearing should be kept to a minimum. » Impacts to restricted or important habitats such as the drainage lines should be avoided. The final placement of turbines must follow a micro-siting procedure involving a walk-through and identification of any sensitive areas by botanical, faunal and avifaunal specialists.		
Cumulative impacts: There is very little other development in the area and apart from the Copperton mine which is some distance from the facility. The potential for cumulative impacts is low on account of the largely intact nature of the surrounding landscape. .		
Residual Impacts: Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.		

Nature: Reduced landscape connectivity.

The extensive road network which is likely to amount to 42 km of hardened access roads is likely to have an impact on landscape connectivity for fauna. The current roads and tracks at the site are narrow and in most instances, have been cleared of vegetation only within the tyre tracks. The access roads required for the development will be approximately 7 m wide and will need to be compacted so that they can support the heavy vehicles that must bring the turbine components in. Within the sandy lowlands, such roads would represent a barrier to movement for subterranean species. Slow moving species such as tortoises and some snakes are also vulnerable to predation when exposed and may suffer increased predation rates as a result of the roads. Although the impact at any one time is small, the roads may result in a longer-term cumulative impact and species which reproduce slowly such tortoises may be particularly affected. Larger mammals are likely to be less impacted due to their mobility.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	Medium(4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (30)**
Status (positive or negative)	negative	negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree	
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 development would contribute a small amount to the cumulative loss of landscape connectivity, but this is not likely to be highly significant when considered at the landscape scale.

Residual Impacts:

As the roads and turbines will continue to be present for the lifetime of the facility, some residual impact will remain for the lifetime of the facility.

Nature: Direct Faunal Impacts

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

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (4)	Short-term (4)
Magnitude	Medium (5)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**medium (44)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

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.
» Fires should only be allowed within fire-safe demarcated areas.
» No fuelwood collection should be allowed on-site.
» No 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 potential for cumulative impacts is relatively low as there are few other developments currently underway in the area which might generate similar impacts. .

Residual Impacts:

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

Nature: Increased erosion risk

The development of the site would create a lot of soil disturbance and loss of vegetation cover, which would leave the site susceptible to wind and water erosion. The hardened surfaces of the roads would generate a lot of runoff, which may affect the areas receiving the runoff. Particular risk areas include the slopes of the rocky hills as well as the areas near to the drainage systems of the site.

	Without mitigation	**With mitigation**
Extent	Local (2)	local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (6)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (18)**
Status (positive or negative)	negative	negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
» Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
» All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.

Cumulative impacts:

Higher sediment loads in rivers and streams will affect in-stream vegetation and biota.

Residual Impacts:

If erosion at the site is controlled, then there will be no residual impact

Implications for Project Implementation

» Overall the site appears to be a favourable location for the proposed wind energy facility. There are some sensitive habitats present such as the drainage

lines and rocky hills, but even these do not harbour a large amount of rare or endangered species. Therefore, the impacts of the development are likely to be largely local in nature and there do not appear to be any impacts which would be of wider significance.

» The development of the facility would result in the loss of some habitat for fauna and flora. However, this would amount to about 100 ha, which is not highly significant when considered in the light of the surrounding landscape which is almost entirely intact.
» The site does not appear to contain any specific features that are not also widely available in the surrounding landscape.
» In the long-term erosion is one of the major risks associated with the development. The road network required for the facility will be at least 60km long and the hardened surface will generate a lot of runoff which may cause erosion if not properly directed and regulated.
» Provided that suitable measures to avoid erosion are implemented in the design of the facility and that effective erosion control and mitigation measures to reduce the other impacts of the development are implemented, the development of the site is not likely to result in significant degradation or biodiversity loss within the receiving environment.

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

» Internal access roads must be planned in such a way as to avoid drainage lines, as far as possible.
» Planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and cable alignments should coincide as far as possible.
» A permit will have to be obtained from DWA to impact on any wetland or water resource.
» Erosion control measures should be put in place as erosion will also promote invasion of the site by alien invasive plants.

7.3.2 Assessment of Potential Impacts on Avifauna

The site is relatively flat, and predominantly consists of short vegetation. This open arid vegetation favours large terrestrial species such as bustards and korhaans, raptors, and small terrestrials such as larks. Up to approximately 150 bird species

could occur on site (according to Harrison *et al*, 1997). This is a relatively low diversity of species, reflecting the aridity and uniformity of the study area, as well as possibly the low number of counts or cards submitted (the more counts the more chance of detecting additional species). In total, according to Harrison *et al* (1997), 9 Red Listed species could occur here, comprising 3 Vulnerable (V) and 6 Near-threatened (NT) species. In addition, the White Stork *Ciconia ciconia* was considered as threatened as it is afforded protection internationally under the Bonn Convention on Migratory Species. Almost all of these Red Listed species are important with respect to wind energy facilities. A list of 'target species' has been developed based on various data sources. Target species are those species requiring special conservation attention with respect to the proposed wind energy facility. These species are as follows: Lesser Kestrel; Kori Bustard; Ludwig's Bustard; Secretarybird; Lanner Falcon; Cape Long-billed Lark; White Stork; Jackal Buzzard; Black-shouldered Kite; Rock Kestrel; Greater Kestrel; Southern Pale Chanting Goshawk; Karoo Korhaan; Northern Black Korhaan; and Namaqua Sandgrouse. The large terrestrial species such as the bustards, storks, flamingos and Secretarybird are all believed to be likely to collide with wind turbines, mainly based on their proven vulnerability to collision with overhead power lines. The smaller species such as the larks could most likely be impacted on through disturbance and habitat destruction. The raptors, such as Lesser Kestrel, are also believed to be at high risk of collision.

The potential interactions between these birds and the proposed facility are: disturbance of birds during construction and maintenance; habitat destruction during construction and maintenance of the facility and associated infrastructure; displacement of birds from the site, or from flying over the site; collision of birds with turbine blades during operation; and collision and electrocution of birds on associated electrical infrastructure.

With respect to the assessment of these potential impacts for the Garob Wind Farm, the following are key findings: disturbance of birds, habitat destruction, and displacement of bird are all anticipated to be of relatively low significance. This is primarily due to the vast amount of similar habitat available in this part of the Northern Cape. In other words the proposed site does not offer any unique habitat based on the avifaunal specialist view. Collision and electrocution of birds on any necessary new overhead power line is likely to be of medium significance, but is relatively straight forward to mitigate for and can be reduced to low significance. Collision of birds with turbine blades could also be of medium significance, although it is uncertain whether target species move over the site frequently enough to present a high risk of collisions occurring.

A pre-construction bird monitoring programme has been initiated on site, in accordance with the best practice guidelines currently available (Jenkins *et al*,

2011). Two site visits (winter and spring) have so far been completed and the early indications are that bird flight activity on site is very low. Although this is expected to increase in the warmer seasons it is an indication that the significance of collision could be reduced to low. The species that have been recorded flying across the site are also predominantly non Red Listed species to date, such as Northern Black and Karoo Korhaan and Southern Pale Chanting Goshawk. At this stage, this impact is rated as low significance.

Micro-siting of turbines and other infrastructure within the proposed site remains the foremost means of mitigating the above discussed impacts on birds. The avifaunal study has identified preliminary high avifaunal sensitivity areas on the site based on micro habitats, consisting of surface water and likely flight paths (see Figure 7.3). As far as possible, construction of infrastructure should not take place within these areas or their buffers. Ideally sensitivity mapping and consequent turbine micro siting would also incorporate actual data on target bird species flight paths, collected through pre- construction bird monitoring. Based on the first monitoring data there do not appear to be any flight paths evident at this stage.

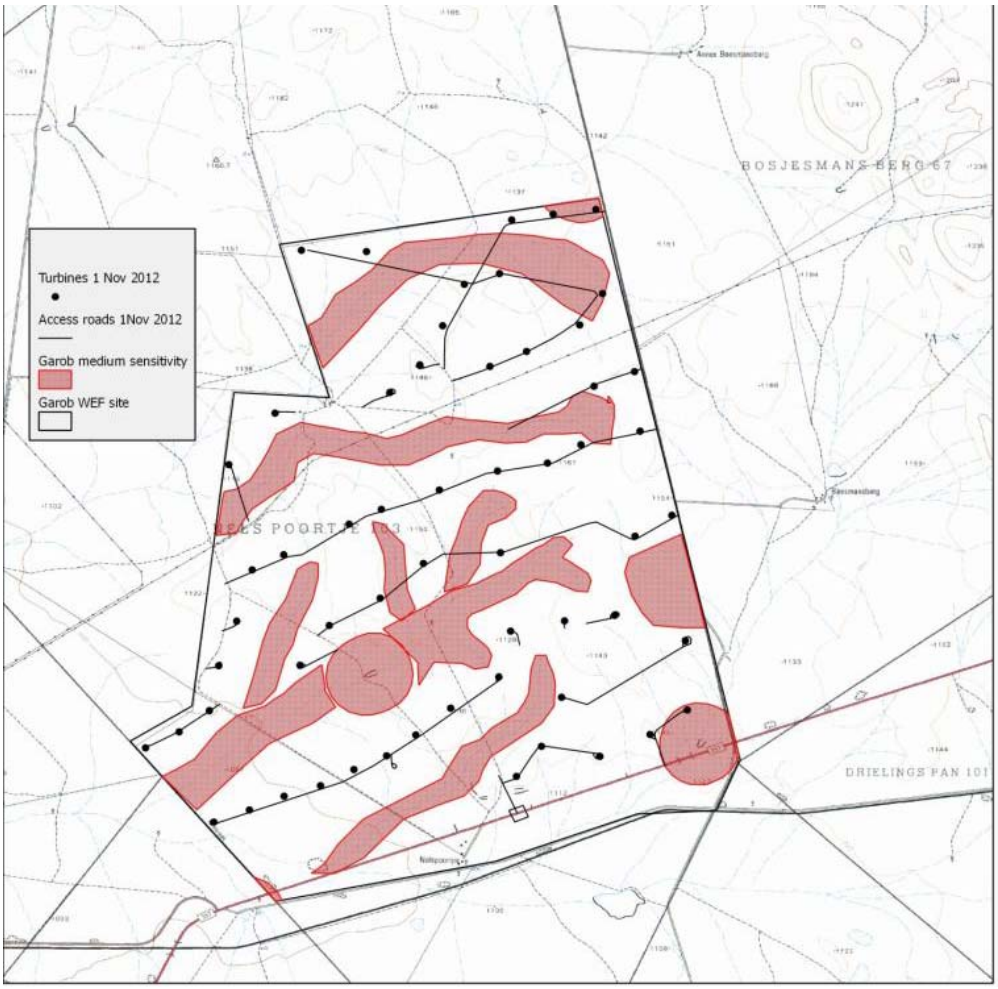


Figure 7.3: Avifaunal Sensitivity map for the Garob Wind Farm study area. Red areas indicate medium sensitivity, dams and drainage lines

Impact table summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Habitat destruction during construction of wind energy facility		
Since the site is situated in an extremely uniform area and does not appear to possess any unique habitat, this impact is not anticipated to of high significance for most of the site. The exception to this will be some of the areas identified in the sensitivity mapping exercise, in particular any surface water sources or significant drainage lines.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (4)	Probable (4)
Significance	**28 (low)**	**28 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate; if the facility were removed, vegetation would probably recover to some extent	
Irreplaceable loss of resources?	No	Yes
Can impacts be mitigated?	Not substantially, a certain amount of habitat has to be altered	
Mitigation: » Micro siting of turbines to avoid sensitive areas. » Strict control of machinery, staff and equipment to ensure no unnecessary damage to vegetation		
Cumulative impacts: Could be quite substantial if more projects are built in the same area. At this stage there are two other wind projects, and some solar facilities planned in the broader area. Collectively these facilities could remove quite a lot of habitat from the area. However, on a landscape level this is still not believed to be significant in this area.		
Residual Impacts: Minimal; vegetation would probably recover to a large extent		

Nature: Disturbance of birds during construction and maintenance of the wind energy facility This is unlikely to be of high significance for the target species, unless breeding on site – which has not been recorded to date.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Very Short (1)	Very Short (1)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)

Significance	**28 (Low)**	**28 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	High; if disturbance ceased birds would recover	
Irreplaceable loss of resources?	No – unless through failed breeding, but no key species found breeding on site to date	Yes
Can impacts be mitigated?	Partially	
Mitigation: » Avoid sensitive areas of site as identified (see figure 7.3) » Maintain strict control of vehicles, staff and machinery at all times.		
Cumulative impacts: Could be quite substantial if more projects are built in the same area. At this stage there are two other wind projects, and some solar facilities planned. Collectively these facilities could remove quite a lot of habitat from the area. However ,on a landscape level this is still not believed to be significant in this area.		
Residual Impacts: None		

Nature: Displacement of birds during operation of the wind energy facility The likelihood of this impact being significant is related to how many birds actually use and depend on the site. At this stage it is not anticipated to be a significant impact.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**24 (low)**	**24 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	High – removal of facility would cause birds to revert to their original behaviour	
Irreplaceable loss of resources?	No not necessarily	
Can impacts be mitigated?	No	
Mitigation: The only way to mitigate this impact would be to curtail or shut down certain or all turbines. This is considered extremely unlikely to be necessary at this site.		
Cumulative impacts: Could be quite substantial if more projects are built in the same area. At this stage there are two other wind projects, and some solar facilities planned. Collectively these facilities could remove quite a lot of habitat from the area. However, on a landscape level this is still not believed to be significant in this area.		

Residual Impacts:
Birds displaced from the site may not return to re- inhabit their old territories.

Nature: Collision of birds with turbine blades during operation of wind energy facility		
This impact is likely to affect species such as korhaans, bustards, storks and raptors if they fly frequently enough on and across the site. The pre-construction bird monitoring programme has been initiated in order to gather data on frequency of flights on site. The data from the first two site visits points towards very low flight activity on site.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Improbable (2)
Significance	**22 (low)**	**22 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – birds are killed	Yes
Can impacts be mitigated?	Not very effectively	
Mitigation: » The best mitigation measure prior to construction is to ensure that the turbines are sited in a way that poses the least possible collision risk to birds. This has partially been done based on sensitive habitats (dams and drainage lines). However the avifaunal input into turbine siting will be far stronger based on pre-construction bird monitoring data. » If collisions are frequent post construction the operator will need to consider mitigation measure such as curtailment or even shut down of particular turbines.		
Cumulative impacts: Since there are at least 2 other wind farm projects proposed in the Copperton area there is a risk that the cumulative impact of all sites on particular species could be great. However, it is not considered likely that this will be a major factor in this area given the uniformity of the habitat, and the relative lack of sensitive features on site which could attract high numbers of birds.		
Residual Impacts: If the facility were decommissioned the impact would cease, but birds already killed could not be recovered.		

Nature: Habitat destruction during construction of roads, substations, and other infrastructure As with the main wind energy facility described above, these impacts are anticipated to be of medium significance		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**35 (Medium)**	**35 (medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes – partially	
Mitigation: » Micro siting of turbines to avoid sensitive areas. » Strict control of machinery, staff and equipment to ensure no unnecessary damage to vegetation		
Cumulative impacts: Could be quite substantial if more projects are built in the same area. At this stage there are two other wind projects, and some solar facilities planned. Collectively these facilities could remove quite a lot of habitat from the area. However on a landscape level this is still not believed to be significant in this area.		
Residual Impacts: Vegetation could probably recover to a large extent		

Implications for Project Implementation

» The proposed development is likely to pose potential impacts on birds predominantly through collision with turbines.
» The proposed site does not offer any unique habitat for avifauna.
» Findings of the on-going bird monitoring should be used in the finalisation of the layout.
» Responsible implementation of required mitigation measures should reduce detrimental construction and operational phase impacts to tolerable and sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South Africa avifauna.
» The impacts of this development must be viewed in the context of the potential cumulative effects generated by at least two other wind energy projects proposed for the same general area.

7.3.3 Assessment of Potential Impacts on Bats

A number of factors influence the number of bats disturbed and/or killed at energy facilities. These can be classified into three broad groupings:

» facility related information – physical damage to the bat caused by actual collision with the turbines
» site related information – alterations to the bats' prey-base during and after construction, as well as changes in roost site availability
» bat related information – the barotrauma that operating turbines can cause to bats.

In this regard, in order to assess the potential impact on bats, a study was conducted to identify bat species that can potentially occur on site. Bat species that could potentially occur on site include one Vulnerable (*Cleotis percivali)*, three Near-threatened (*Cistugo seabrae*, *Eidolon helvum, Miniopterus* and *natalensis)* seven Least Concern (*Eptesicus hottentotus*, *Myotis tricolor*, *Neoromicia capensis*, *Nycteris thebaica*, *Rhinolophus clivosus*, *Rhinolophus darlingi* and *Tadarida aegyptiaca)* and one Data Deficient (*Rhinolophus denti*) species potentially occur in the area of the study site. Four species were confirmed to occur at the study site using call identification techniques (*Neoromicia capensis, Eptesicus hottentotus, Miniopterus natalensis* and *Tadarida aegyptica*). Only *M. natalensis* is Near Threatened, the rest are considered Least Concern.

Any species that occur in the area of the proposed wind energy facility is vulnerable to the potentially fatal impacts of wind turbines. Since only one of the species identified as potentially occurring in the area of the study site is listed as Vulnerable (*Cleotis percivali)* and only one of the recorded bats is listed at Near Threatened (*M. natalensis*) and the fact that no potential roost sites were identified on the site, the overall impact of the development should be low to moderate. The uniformity of the habitat around the site also suggests that, although localised habitat destruction and disturbance would impact on bats, the habitat is not unique or important for bats and as such the surrounding habitats would be equally available to bats to utilise.

The topography of the site, along with observations made during the site visit, were used to designate the permanent water sources, riparian valleys and their slopes and the permanent man-made structures with evidence of bat occupation (identified either by bat passes recorded or bat dropping on walls) as having High Bat Sensitivity (refer to Figure 7.4).

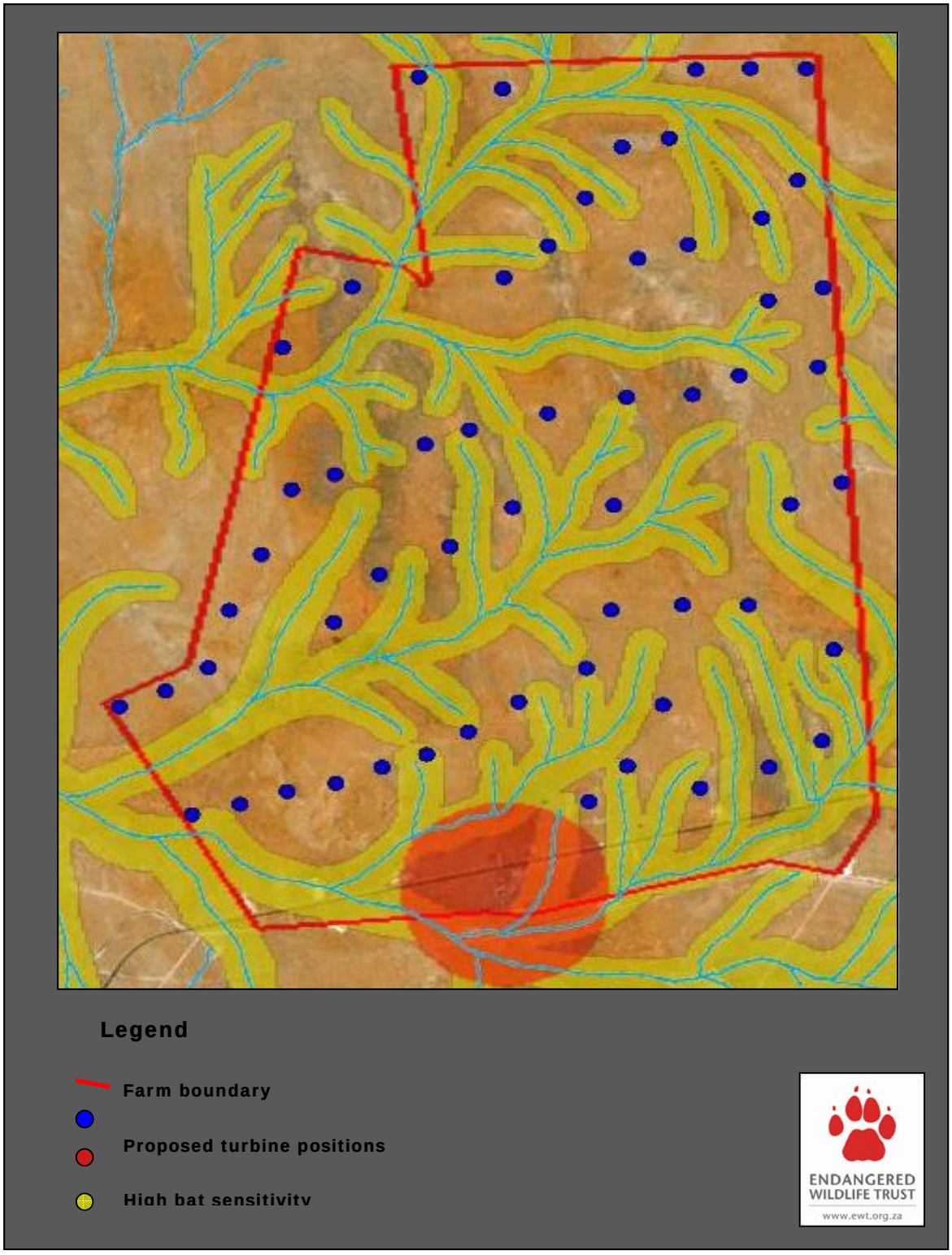


Figure 7.4: Potential bat sensitivity in the study area

The areas assigned Moderate Bat Sensitivity include non-riparian slopes and non-perennial riverbeds. These areas were designated based on their higher likelihood of supporting insects, and thereby attracting bats, and higher likelihood of providing

suitable roost sites. Mitchell-Jones and Carlin (2009) and Rodrigies *et al.* (2008) indicate that a minimum buffer distance of 200m from features important to bats should be maintained.

None of the proposed Turbines are located in areas of High Bat Sensitivity and although Turbines 1, 6, 9, 16, 18, 21, 28, 30, 32, 40, 41, 45, 46, 53 and 58 are located in the areas of Moderate Bat Sensitivity (represented completely by dry riverbeds) due to the uniformity of the habitat and brief period these riverbeds carry water each season it is unlikely that their locations will have a significant impact on bat species in the area. They must, however, at least be prioritized in post-construction monitoring and implementation of mitigation measures.

Impact tables summarising the significance of impacts on bats (with and without mitigation)

Nature: Roost disturbance and/or destruction due to construction activities

No obvious roost sites, such as caves, large trees or unused mine shafts were found in the uniform Bushmanland Arid Grasslands of the study site itself. A number of small man-made structures were located on the site and, although no direct evidence was found at these sites, it is possible that bats may use them seasonally as roost sites. In addition reservoirs, drinking troughs and kraals on the site may attract insectivorous bats to drink and feed.

The farm houses (and related structures) in the south of the site had some evidence of occupation by bats including bat smudges and droppings. Many suitable roost sites were identified at the nearby abandoned Copperton Mine. Buildings, mine shafts and remains of the mine's head gear were all identified as potential roost sites

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small (0)	Small (0)
Probability	Improbable (1)	Improbable (0)
Significance	**6 (Low)**	**0 (Low)**
Status	Neutral	Neutral
Reversibility	N/A	N/A
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes

Mitigation:

» Since no active bat roosts or habitat suitable for bat roosts were found 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: Marginal – the impact of two developments of a similar nature is likely to be less than twice the impact from a single development. To reduce the possibility of impacting any bat roosts in the area it would be better to place a second development in the same environment should this be a consideration.
Residual impacts: Low – it is unlikely that any roosts will be disturbed or destroyed

Nature: Bat fatalities due to collision or barotrauma while foraging

Bat mortalities at wind farms due to collision with turbine blades and barotrauma has 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 (for example the Near Threatened *M. natalensis*).

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. None of the proposed Turbines are located in area of High Bat Sensitivity and although Turbines 1, 6, 9, 16, 18, 21, 28, 30, 32, 40, 41, 45, 46, 53 and 58 are located in the areas of Moderate Bat Sensitivity due to the uniformity of the habitat it is unlikely that their locations will have a significant impact on bat species in the area.

Since this study showed that bats occur across the entire study area assessed it is likely that the proposed development will have a moderate 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.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**36 (Medium)**	**32 (Medium)**
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	Yes	Yes

Mitigation:

» Areas around Turbines 1, 6, 9, 16, 18, 21, 28, 30, 32, 40, 41, 45, 46, 53 and 58 must be prioritised in post-construction monitoring and implementation of mitigation measures.
» Gaps of at least 250m should be left between turbines.
» Informed curtailment programmes should be adopted if 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.
Cumulative impacts: Marginal – The impact of constructing a second development in the same environment will result in higher bat mortality due to collision and/or barotrauma but splitting the two developments into separate environments may have an even larger impact.
Residual impacts: High – permanent impact of turbines.

Nature: Disturbance to and displacement from foraging habitat due to wind turbine construction and operation		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**36 (Medium)**	**24 (Low)**
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 an on-site environmental control officer. The disturbance should decrease after construction is complete. » 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 be 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. » It is advisable to keep lighting to a minimum to avoid attracting certain species and to avoid disturbing others. » Should impacts associated with lighting become a large problem a suitably qualified bat specialist should be contacted to resolve the issue. » It is suggested that during construction newly constructed buildings be sealed as much as possible from bats.		
Cumulative impacts: Marginal – The impact of constructing a second development in the same environment will result in higher displacement but splitting the two developments into separate environments may have an even larger impact.		
Residual impacts: Medium – temporary impact from construction but large impact from lighting.		

Nature: Bat fatalities due to collision or barotrauma during migration

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.

	Without mitigation	***With mitigation***
Extent	Region (3)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (5)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**48 (Medium)**	**30 (Medium)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Possible loss of breeding success and population impacts	Possible loss of breeding success and population impacts
Can impacts be mitigated	Yes	Yes

Mitigation:

» 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.
» 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

Implications for Project Implementation

» Any species that occurs in the area of the proposed wind energy facility is vulnerable to the potentially fatal impacts of wind turbines. Since no active bat roosts or habitat suitable for bat roosts were found on the site the, impact of the construction of the wind energy facility on roosts is expected to be low to moderate.
» The uniformity of the habitat around the site suggests that, although localized habitat destruction and disturbance would impact on bats, the habitat is not unique or important for bats and as such the surrounding habitats would be equally available to bats to utilize.
» If any bat roosts are discovered, a suitably qualified specialist must be contacted for assistance in dealing with the roosts
» None of the proposed Turbines are located in area of High Bat Sensitivity and although Turbines 1, 6, 9, 16, 18, 21, 28, 30, 32, 40, 41, 45, 46, 53 and 58 are

located in the areas of Moderate Bat Sensitivity due to the uniformity of the habitat it is unlikely that their locations will have a significant impact on bat species in the area. They must, however, at least be prioritized in post-construction monitoring and implementation of mitigation measures.

» Gaps of at least 250m should be left between turbines.
» A pre-construction bat monitoring programme should be implemented.

7.3.4 Assessment of Potential Impacts on Soils and Agricultural Potential

The agricultural potential of the site is low and limited by low rainfall and limited water availability. The main impact on soils associated with the construction of the proposed wind energy facility relates to soil disturbance and erosion. The environmental impact assessment aimed to evaluate the impact that the proposed activity will have on soils and agricultural potential and attempted to provide mitigating measures to minimise the impact.

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

Nature: Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off The soil erosion potential of the site is relatively low, due to the absence of steep slopes, the specific soil forms present and soil surface condition of the soils. The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas. In addition, it is recommended that on the steeper slopes the roads follow less direct routes with lower erosion risk or contain switchbacks which reduce the slope angle and limit the slope length that water would travel before leaving the road.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established.		

» Care should also be taken to control and contain storm water run-off. An appropriate stormwater management plan must be developed and implemented during construction and operation. » Rehabilitate construction sites by establishing it with indigenous grasses like *Anthephora pubescens, Cenchrus ciliaris, Eragrostis curvula*, etc.
Cumulative Impacts: Little with the necessary mitigation in place
Residual Impacts: Little with the necessary mitigation in place

Nature: Siltation of watercourses and other natural resources Siltation of watercourses and other natural resources downstream may occur as a result of improper storm water management and soil erosion due to increased and concentrated water run-off.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**45 (Medium)**	**10 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. » Care should also be taken to control and contain storm water run-off. An appropriate stormwater management plan must be developed and implemented during construction and operation. » Rehabilitate construction sites by establishing it with indigenous grasses like *Anthephora pubescens, Cenchrus ciliaris, Eragrostis curvula*, etc.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Nature: Dust production and dust pollution of grazing plants		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**21 (Low)**	**10 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Apply appropriate dust control measures, e.g. water spraying.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Nature: Denudation of the soil due to construction activities and loss of carrying capacity The construction activities, specifically the construction of underground cabling between the wind turbines and the substation, will lead to areas where the soil will be denuded of vegetation.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**40 (Medium)**	**25 (Low)**
Status	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Rehabilitate construction sites as soon as possible after construction is complete in an area by establishing it with indigenous grasses like *Anthephora pubescens, Cenchrus ciliaris, Eragrostis curvula*, etc.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Nature: Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site

During the construction phase there may be an impact on the normal day-to-day management of the livestock and the veld management system, due to interference with systems like water reticulation and fencing.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» When farming infrastructure, i.e. fences, water pipelines, water troughs, etc., is removed or damaged, it should be replaced as soon as possible.

» Construction and other activities must be communicated and co-ordinated with the land owner to put him in a position to properly plan his management activities.

Cumulative Impacts:

Little with the necessary mitigation in place

Residual Impacts:

Little with the necessary mitigation in place

Nature: Soil erosion from road surfaces

A few of the roads on the site, specifically those situated on sandy slopes, display minor water erosion taking place due to the absence of cross mounds which slow down the speed and force of the drainage water. The roads on the more gravelly areas of the site display no such water erosion, even on slopes.

The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**35 (Medium)**	**10 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of	Yes	No

resources?		
Can impacts be mitigated?	Yes	
Mitigation: » Care should be taken to put gravel on access road surfaces to protect the soil against wind and water erosion, with special care taken on soils of the Plooysburg form and specifically on slopes. » Cross mounds and other storm water drainage techniques must be employed to decrease the speed and force of the storm water properly from road surfaces. » It is recommended that on the steeper slopes the roads follow less direct routes with lower erosion risk or contain switchbacks which reduce the slope angle and limit the slope length that water would travel before leaving the road.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Nature: Loss of vegetation and carrying capacity New roads will contribute to the loss of vegetation and carrying capacity, although the impact is considered to be medium taking into account the relatively low grazing capacity of the veld. Care should be taken, though, to make use of existing roads on the site as far as possible so as to minimise the construction of new roads.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**40 (Medium)**	**40 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Make use of existing roads as far as possible to minimise loss of vegetation and carrying capacity.		
Cumulative Impacts: Little, as long as the roads are not an additional source of erosion and storm water		
Residual Impacts: Permanent		

Nature: Contamination and degradation of the soil due to spillages of oil, petrol, diesel and other contaminants used by vehicles and equipment on the site or stored on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**30 (Low)**	**20 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Vehicles and equipment must be serviced regularly and maintained in a good running condition. » Storage of contaminants must be limited to low quantities and done under strict industry standards e.g. contained in bunded areas. » There must be strict control over the safe usage of vehicles and equipment to minimise vehicle accidents and damage to vehicles by rocks and boulders which may cause spillages.		
Cumulative Impacts: None		
Residual Impacts: Spillages of contaminants will have a long residual effect on the natural resources, specifically to the soil and vegetation, and possibly the underground water depending on the quantum of the spillage.		

Implications for Project Implementation

» The soils on the site are susceptible to both water and wind erosion, although the susceptibility is categorized as low to medium.
» The proposed development of a wind energy facility on the site will not have large impacts due to the low agricultural potential of the area proposed for development.

7.3.5 Assessment of Potential Impacts on Heritage Sites and Palaeontology

Most of the recorded heritage find spots and sites within the Garob Wind Facility area occur within the southern portion of the surveyed area where the calcrete is eroding from under the Aeolian sands or in areas where hard packed Aeolian sands are found. In the northern portion the Aeolian sands are much deeper, in some

cases deeper than 30-40 cm, vegetation in this area is also much higher with grasses and shrubs standing 50-70 cm high hampering archaeological visibility. Artefact counts drops drastically as one moves from south to north into this sandy area, however, the occasional MSA or LSA flake was noted in these areas, where the Aeolian sands most probably buried most of the MSA and ESA. The area of deep Kalahari sands within the site is easily visible on Google earth

Artefacts were observed in low densities over much of the study area where quartz, quartzite and cryptocrystalline silica (CCS) is used as raw material. Some of the artefacts show a high degree of weathering probably being washed in from their original context and are therefore of little archaeological value. In areas where slightly elevated frequencies of artefacts occurred these where documented as find spots and when the artefact ratio is higher than 5 per m² these were documented as ‘sites’. The use of the term 'site' was entirely arbitrary and does not necessarily reflect a knapping, quarry or habitation site. GPS points were taken at such places and selections of artefacts were photographed. ESA, MSA and LSA artefacts are mixed and indicate that downward deflation had occurred in the study area.

Ten sites were recorded (see Figure 7.5) consisting of seven Stone Age sites (Site 1, 3, 4, 5, 7, 8, and 10) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 6) as well as historical/recent exploration or quarrying (Site 9). A further total of 18 find spots were mapped, recorded and digitally photographed. Again, assemblages at the locations are mixed, mainly consisting of MSA and LSA artefacts with some ESA artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure.

From a palaeontological point of view, the site occurs in an area that contains Precambrian metamorphic rocks which do not contain fossils, Permo-Carboniferous Dwyka deposits of the Mbizane Formation and Quaternary deposits belonging to the Gordonia Formation. The Dwyka deposits comprise a very small portion of the site and rarely contain fossils. Fossils recovered from Quaternary deposits are almost always found in caves or in the banks of steep-sided river gulleys.

The low-lying relief and absence of potentially fossiliferous gulleys on the site strongly suggest that fossils are absent from this site. Considering the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e. steep-sided gulleys) at the proposed site, the impact on palaeontological material on Portion 5 of Farm 103 is negligible (rated Low or negative).

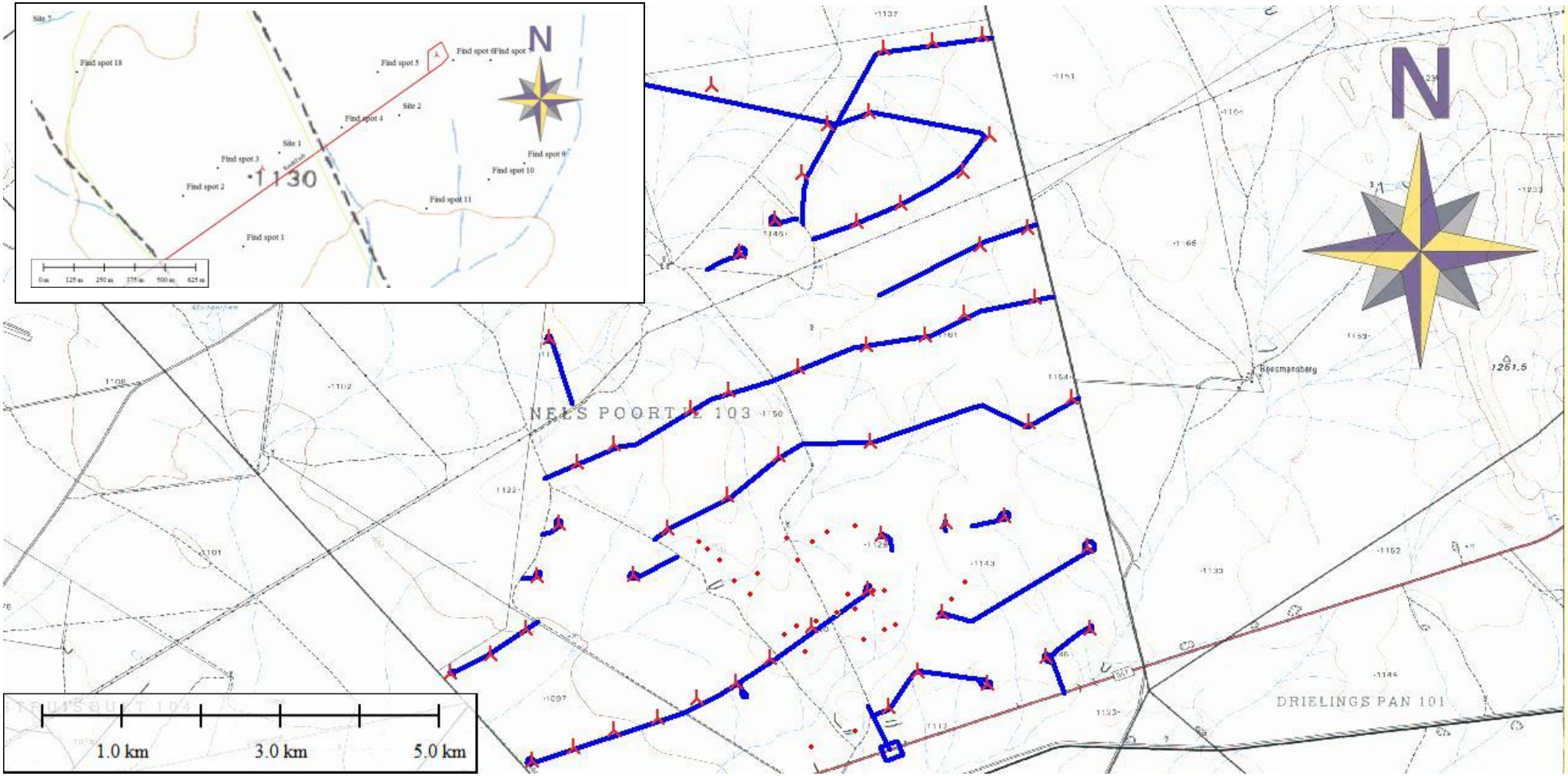


Figure 7.5: Site distribution map showing sites and find spots in relation to turbines and new access roads

Impact table summarising the significance of impacts on Heritage Sites and Palaeontology (with and without mitigation)

Nature: Destruction of Heritage sites (sites 1 to 10) During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (1)
Probability	Probable (1)	Probable (1)
Significance	**9 (low)**	**8 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: 10 sites were identified during the survey. None of these sites will be directly impacted by the proposed development. However, if any archaeological material is uncovered during construction or operation a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of archaeological record of the area.		

Nature: Destruction of Heritage sites(find spots 1- 9, 15 and 18) During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (1)
Probability	Probable (1)	Probable (1)
Significance	**9 (low)**	**8 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Yes	
Mitigation: The new revised layout facilitated the protection of these sites and no direct impact is foreseen on the sites and no mitigation is required. However, if any archaeological material is uncovered during construction or operation in these areas a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of archaeological record of the area.		

Implications for Project Implementation

» Any deviation in the turbine positions must be assessed by an archaeologist.
» The stone walled enclosure (Site 2) must be regarded as a no go area. On the current layout this site will not be impacted. However, future expansion must take this area into account.
» It is further recommended that a Conservation Management Plan is drawn up and included in the EMP for the project to protect no go areas in the study areas.
» If any possible finds such as tool scatters, bone or fossil remains are exposed or noticed during construction, the operations must be stopped and a qualified archaeologist must be contacted to assess the find.

7.3.6 Assessment of Potential Visual Impacts

The visibility analysis was undertaken from 58 wind turbine positions at an offset of 120m above average ground level (i.e. the maximum hub height of the proposed turbines) (refer to Figure 7.6). It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.

The viewshed 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. 53-58 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-6 turbines or parts thereof may be visible).

The proposed facility will have a large core area of potential visual exposure, with a high frequency of exposure, on the project site itself, and within a 5km offset (refer

to Figure 7.7). Potential visual exposure is slightly reduced in the medium distance (i.e. between 5km and 10km), with some visually screened areas in the east and north east (beyond the local hills), and to a lesser extent to the north-west and south. The frequency of exposure remains high, however. The town of Copperton falls within this distance from the facility. In the longer distance (i.e. beyond the 10km offset), the extent and frequency of potential visual exposure is further reduced. Visually exposed areas occur mainly in the north and south west. Areas in the north east, east and south east are less exposed to potential visual impact. Visually exposed areas are fragmented due to topography. The town of Prieska is located more than 10km from the site and is not likely to be visually exposed, with the hills in the far north east of the study area protecting the town from potential visual exposure. The south western slopes of these hills are visually exposed, but it is unlikely that the facility will be visible from this distance

Potential visual impact assessment –visual impact index

The results of analyses including visibility analysis / exposure (Figure 7.4); observer proximity to the facility (refer to Figure 7.5); viewer incidence / viewer perception; and visual absorption capacity (VAC) are merged to form a Visual Impact Index in order to determine where the areas of likely visual impact would occur. These areas were further analysed in order to judge the severity of each impact (refer to Figure 7.7).

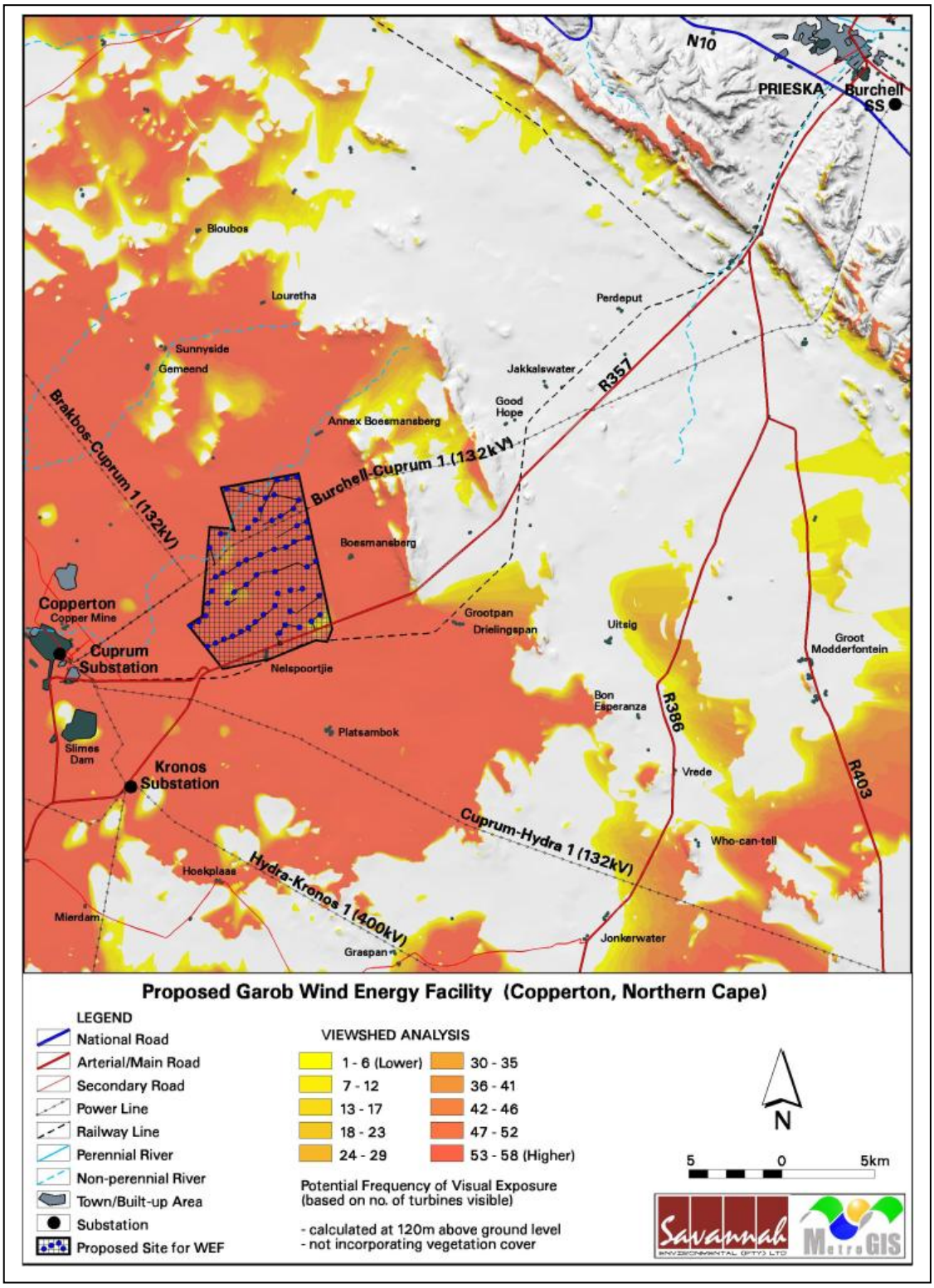


Figure 7.6: Potential visual exposure of the proposed Garob Wind Farm

The potential visual exposure as illustrated is a theoretical representation of where visual receptors would be able to see the facility from. This does not take into consideration local factors such as vegetation, orientation of structures and views, and localised topographical features

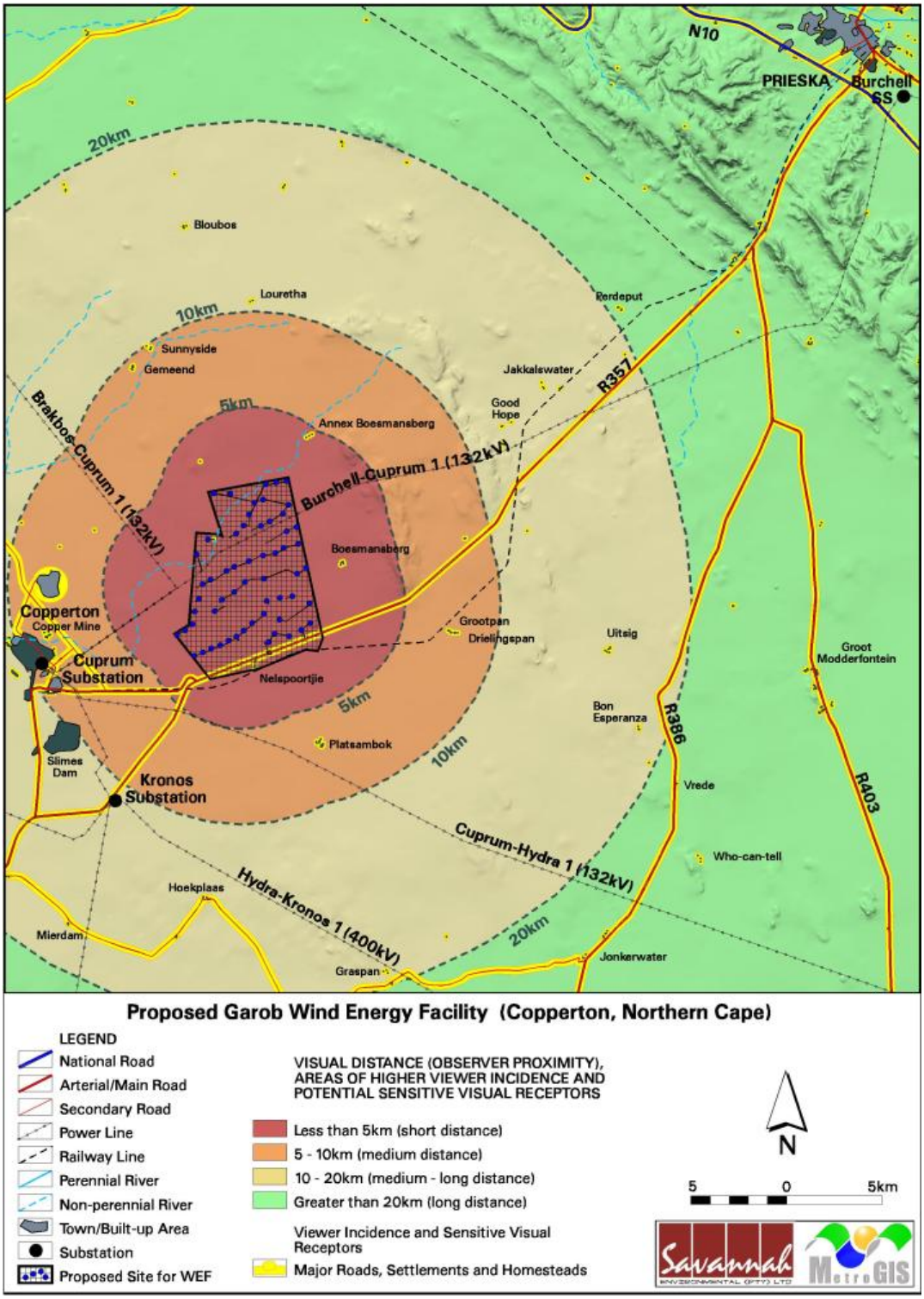


Figure 7.7: Observer proximity to the proposed WEF and areas of viewer incidence

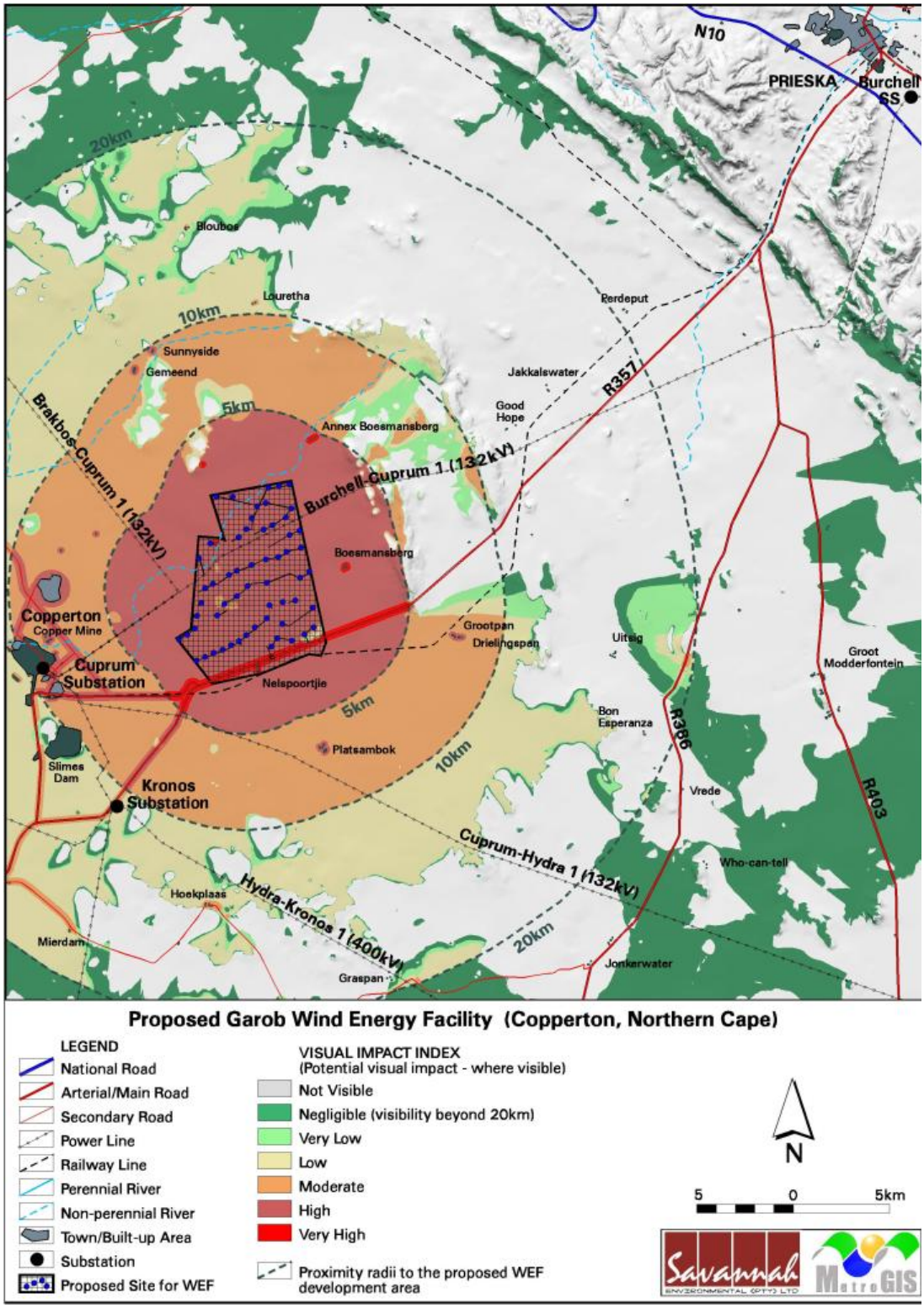


Figure 7.8: Visual impact index of the proposed Garob Wind Farm

Results of the Visual Assessment

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Garob Wind Farm are displayed on **Figure 7.8**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been 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 impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index for the Garob Wind Farm is further described as follows.

» The visual impact index map indicates a core zone of **high** visual impact within a 5 km radius of the proposed facility. Sensitive visual receptors within this zone include users of the R357 in the south and residents of the settlements of *Annex Boesmansberg, Boesmansber* and *Nelspoortjie* (amongst others). These receptors are likely to experience **very high** visual impact.

» The extent of potential visual impact remains high between the 5 km and 10 km. Some visually screened areas occur in the east and north east (beyond the local hills), and to a lesser extent to the north-west and south. Visual impacts within this zone are mostly **moderate**, with limited areas of **low** to **very low** magnitude where the frequency of exposure is lower. Sensitive visual receptors again include users of the R357 in the south west, a number of secondary roads in the vicinity of Copperton and residents of Copperton. In addition, residents of homesteads and settlements beyond the town are also likely to be impacted upon. These include *Sunnyside, Gemeend, Copper Mine, Platsambok, Grootpan* and *Drielingspan* (amongst others). These receptors are likely to experience **high** visual impact.

» Between 10 km and 20 km, the extent of potential visual impact is reduced. Visually exposed areas occur mainly in the north and south west. Areas in the north east, east and south east are less exposed to potential visual impact. Visually exposed areas are fragmented due to topography. Visual impacts within this zone are likely to be mostly **low** with limited areas of **very low** to **negligible** magnitude where the frequency of exposure is lower. Sensitive visual receptors at this distance include users of short stretches of the R386 in the east of the study area, and various secondary roads south of Copperton. A few homesteads and settlements, including *Hoekplaas, Louretha* and

Bloubos (amongst others) may also be impacted upon. Visual impacts on these sensitive receptors are likely to be **moderate.**

Remaining impacts beyond the 20 km radius are expected to be **negligible,** where these occur at all.

Impact tables summarising the significance of visual impacts (with and without mitigation)

Nature of Impact: Visual impact on users of arterial and secondary roads in close proximity to the proposed facility

Visual impacts of the wind farm on the R357 arterial road and on various secondary roads in the vicinity of Copperton are expected to be of **high** significance within a radius of 10 km from the proposed facility.

The relatively low incidence of roads (and the anticipated low usage thereof) within this environment and the proximity of the proposed facility to the existing Copperton Mine and associated infrastructure reduces the probability of this impact occurring.

No mitigation of this impact is possible, but measures are recommended as best practice.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very high **(10)**	N/a
Probability	High **(4)**	N/a
Significance	High **(72)**	N/a
Status (positive, neutral or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

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

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as

other alternative energy facilities proposed in the region.

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: Visual impact on residents of homesteads and settlements in close proximity to the proposed facility

The potential visual impact on residents of settlements and homesteads within a 10 km radius of the proposed wind farm is expected to be of **high** significance. These settlements and homesteads include *Annex Boesmansberg, Boesmansber, Nelspoortjie*, *Sunnyside, Gemeend, Copper Mine, Platsambok, Grootpan* and *Drielingspan* (amongst others).

The relatively low incidence of homesteads and settlements within this environment and the proximity of the proposed facility to the existing Copperton Mine and associated infrastructure reduces the probability of this impact occurring.

No mitigation of this impact is possible, but measures are recommended as best practice.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very High **(10)**	N/a
Probability	High **(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 / Management:

Planning:

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

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other alternative energy facilities proposed in the region.

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: 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 10 km radius) is expected to be of **low** significance.

Again, the relatively low incidence of visual receptors within this environment and the proximity of the proposed facility to the existing Copperton Mine and associated infrastructure reduces the probability of this impact occurring.

No mitigation of this impact is possible, but measures are recommended as best practice.

	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?	Yes	

Mitigation / Management:

Planning:

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

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:
The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other alternative energy facilities proposed in the region.

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: Visual impact on the town of Copperton

Copperton is situated less than 8 km from the nearest boundary of the proposed facility, and is therefore considered to be in close proximity thereto. Visual impacts on residents as a result of the proposed facility are expected to be of **moderate** significance. The potential for visual exposure within Copperton is high, but due to the existence of buildings and other structures typical of a more built up area, the visual impact of the proposed facility will be somewhat reduced.

This, in addition to the proximity of the proposed facility to the existing Copperton Mine and associated infrastructure, reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(48)**	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 / Management:

Planning:

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

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other alternative energy facilities proposed in the region.

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: Visual impact of on site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility

On site ancillary infrastructure associated with the wind farm includes the substation, and internal access roads. This infrastructure will be located within the facility footprint but may still be visible to visual receptors in close proximity to the proposed wind farm

The roads have the potential of manifesting as landscape scarring. Other infrastructure has the potential of creating visual clutter, contributing to cumulative impacts, therefore having the potential of visual impact within the viewshed areas.

No dedicated viewsheds have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure 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)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(28)**	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 / Management:

Planning:

» Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as far as possible, and make use of already disturbed areas rather than pristine sites wherever possible.
» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for access roads and ancillary buildings.

Operation:

» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Removal of infrastructure and roads not required for post decommissioning use and rehabilitation of the footprint areas.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the substation and internal access roads will increase the cumulative visual impact of buildings and industrial type infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area.

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: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility.

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, a 480m buffer along the edge of the outer most turbines is submitted as the zone within which there is a risk of shadow flicker occurring.

There are no roads or places of residence within the 480 m 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	None **(0)**	N/a
Probability	Very Improbable **(1)**	N/a
Significance	Low **(8)**	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 / Management:
Turbines located within 480m of any inhabited settlement, homestead or public road should be relocated to beyond this distance in order to negate the potential impact of shadow flicker

Cumulative impacts:
The construction of numerous wind turbines in an area will increase the cumulative visual impact and the potential for shadow flicker within the region.

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

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.

Lighting impacts relate to the effects of glare and sky glow. Source of glare light in include both direct lighting 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.

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The WEF may contribute to the effect of sky glow within this environment.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Low **(28)**
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 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 town of Copperton and the Copperton Mine already generates lighting impacts at night. The impact of the proposed wind farm will contribute to a regional increase in lighting impact.

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: Visual impact of construction on sensitive visual receptors in close proximity to the proposed facility.

During construction, 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 a visual nuisance to other road users and land owners in the area.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(56)**	Low **(30)**
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, provided rehabilitation works are carried out as specified.

Nature of Impact: Visual impact of the proposed facility on the visual quality 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, 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.

An 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. No mitigation of this impact is possible, but measures are recommended as best practice

	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	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 / Management:

Planning:

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

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other alternative energy facilities proposed in the region.

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.

Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Garob Wind Farm 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 as indicated.

Refer to the Visual Impact Assessment (Appendix K) for additional photo simulations.

Viewpoint 1

Viewpoint 1 is located to the immediate south east of the proposed Garob Wind Farm, looking to the north west from the R357. This viewpoint lies less than 2km from the closest turbine and is indicative of a close range view which will potentially be seen when travelling to the south west from Prieska.

Figure 7.9a: Pre construction panoramic overview from Viewpoint 1

Figure 7.9b: Post construction panoramic overview from view point 1

Viewpoint 2

Viewpoint 2 is also located on the R357, some 5km to the north east of viewpoint 1. The point lies approximately 6km form the closest turbine, and is indicative of a medium distance view that visual receptors will have of the facility. The viewing direction is westerly

Figure 7.10a: Pre construction panoramic overview from Viewpoint 2

Figure 7.10b: Post construction panoramic overview from view point 2

Implications for Project Implementation

» Due to the low number of potentially sensitive visual receptors in the study area, the potential visual impact is expected to be of low significance. The proposed facility is therefore considered to be acceptable from a visual perspective.
» A lighting engineer should be consulted to assist in the planning and placement of light fixtures for the turbines and the ancillary infrastructure in order to reduce visual impacts associated with glare and light trespass.
» Turbines located within 480m of any inhabited settlement, homestead or public road should be relocated to beyond this distance in order to negate the potential impact of shadow flicker.
» All activities associated with the construction phase, albeit temporary, should be managed so as to reduce / minimise visual impact during this phase.

7.3.7 Assessment of Potential Noise Impacts

Increased noise levels are directly linked with the various activities associated with the construction of the Garob Wind Farm and related infrastructure, as well as the operational phase of the activity. Noise emitted by wind turbines can be associated with two types of noise sources. These are 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.

Potentially Sensitive Noise Receptors were initially identified during the scoping phase and supported by a site visit during the EIA phase to confirm the status of the identified dwellings (Refer to Figure 7.11).

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103. SANS 10103 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. Ambient (background) noise levels were measured during the day and night time in accordance with the South African National Standard SANS 10103:2003. Unfortunately SANS 10103 does not cater for instances when background ambient sound levels change due to the impact of external forces.

Unfortunately there was significant wind during the site visit which made ambient sound measurements difficult. During periods with low winds, ambient sound levels during the day ranged between 20.7 dBA ($L_{A,min}$) and 22.9 dBA (L_{A90}). Day ambient sound levels between 25 dBA and 35 dBA is expected in areas away from any activity with little or no air movement.

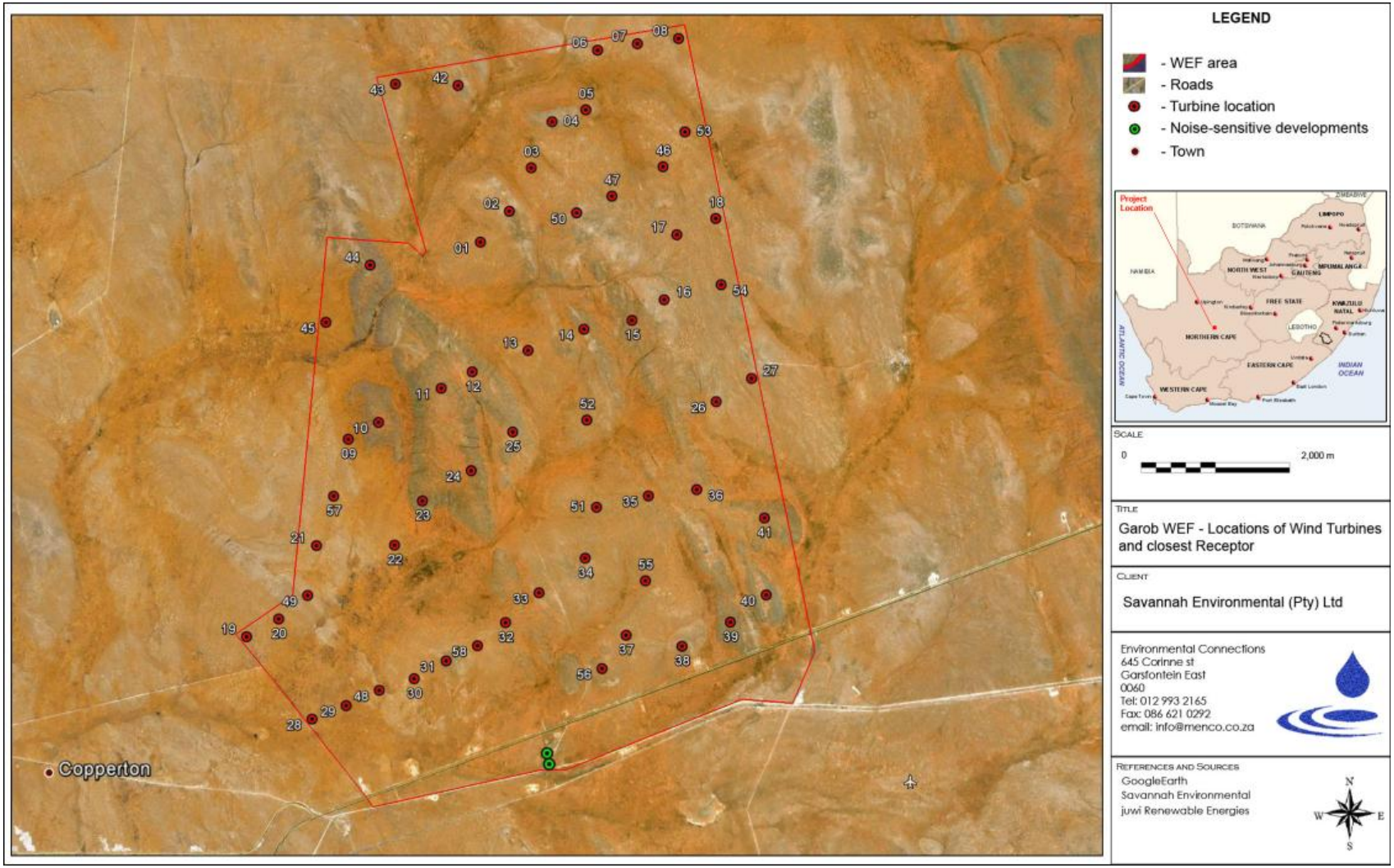


Figure 7.11: Aerial image indicating potentially sensitive receptors (marked as green dots), turbine positions (marked as red dots) and boundaries of the proposed facility

Night-time ambient sound levels ranged from less than 20 dBA ($L_{A,min}$) to more than 35 dBA (L_{A90}). Night ambient sound levels between 20 dBA and 30 dBA is expected in areas away from any activity with little insect or animal sounds and with little or no air movement.

Increased noise levels during construction are directly linked with the various activities associated with the construction of the facility and related infrastructure, as well as the operational phase of the activity. Potential noise sources during the construction phase will originate from:

» Use of construction equipment that is likely to include excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flat bed truck(s), pile drivers, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.
» Material supply where aggregate and cement will be transported from the closest centre to the development site, with the establishment of a small on-site concrete batching plant.
» Blasting may be required as part of the civil works to clear obstacles or to prepare foundations
» A significant source of noise during the construction phase is additional traffic on and off 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 construction phase, however the volume and type of traffic will vary during the construction period.

Potential noise sources during the operational phase will originate from:

» **Wind turbine noise** can be associated with two types of noise source, namely aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment.
» **Transformer noise** which is the "hum" frequently associated with transformers/substations. However, this is a relative easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer equipment.
» **Low frequency noise** from a wind turbine (i.e. typically below 200 Hz) can usually not be detected except very near the source. However, there are people more sensitive to these low frequency sounds. The annoyance is often connected with the periodic nature of the emitted sounds rather than the frequency of the acoustic energy.

Impact table summarising the significance of impacts on Noise Levels (with and without mitigation)

Numerous simultaneous construction activities that could impact on receptors (without mitigation)	
Extent	Local (2) – Change in ambient sound levels would extend further than 1,000 meters from activity
Duration	Temporary (1) – Noisy activities in the vicinity of the receptors would last a portion of the construction period.
Magnitude	Low to very medium (4)
Probability	Probable (2)
Significance	**Low (14)**
Status	Negative
Reversibility	High
Irreplaceable loss of resources?	Not relevant
Can impacts be mitigated?	Not required.
Mitigation: The significance of noise during the construction phase is ***low***, and therefore no additional mitigation measures are recommended or required.	
Cumulative impacts: » This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area.	
Residual Impacts: » This impact will only disappear once construction activities cease.	

Nature: Numerous turbines operating simultaneously during a period when a quiet environment is desirable (without mitigation)	
Extent	Local – Impact will extend less than 1,000 meters from activity (2)
Duration	Long term (4) – Facility will operate for a number of years (5)
Magnitude	Low – medium (4)
Probability	Probable - (2)
Significance	**Low (20)**
Status	Negative
Reversibility	High
Irreplaceable loss of resources?	Not relevant
Can impacts be mitigated?	No noise impact
Mitigation: The significance of the noise impact is considered to be of a ***low*** significance for the closest Noise Sensitive Development and further mitigation measures are not required or recommended.	

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.

Implications for Project Implementation

» The significance of noise impact is considered to be of low significance during both the construction and operational phases. Mitigation measures are therefore not required. However, as a form of good practice the following should be considered:
  * 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 has 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.

» Should the layout (or type of wind turbines used) change significantly, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.

7.3.8 Assessment of Potential Social Impacts

Impacts on the social environment due to the proposed wind energy facility are expected to occur during both the construction and operation phases.

The potential negative impacts associated with the construction phase are typical of general construction related projects and are anticipated to respond to mitigation. These relate to the inflow of workers to the area, inflow of jobseekers, intrusion impacts (e.g. noise pollution, increased vehicle movement and so forth), as well as safety and security issues.

The main potential social benefits associated with the construction and operation of the proposed Garob Wind Farm refers to the job opportunities, the creation of "green energy" and possible socio-economic spin-offs created through the process.

Even though the construction phase would create some job opportunities and the operational phase a very limited number of job opportunities, this aspect still receives a positive rating given the high unemployment levels and large young population profile found in the area. Employment of locals is thus imperative. Failure to do so would result in a negative attitude towards the proposed development and in worst cases could turn into social mobilisation against the project and the applicant.

Some potential negative impacts which may also occur during the operational phase include:

» Influx of job seekers to the area;
» Loss of farm workers to jobs associated with the operational phase;
» The visual impacts and associated impact on sense of place;
» Potential impact on tourism.

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

Impact table summarising the significance of Social Impacts during the Construction Phase (with and without mitigation)

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

The capital expenditure associated with the construction of a 140 MW wind energy facility will be in the region of R 2.5 billion. 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 wind energy facilities 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 Upington and De Aar.

	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 :

Employment

» Where reasonable and practical the contractors appointed by the proponent 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 the proponent and its contractors should meet with representatives from the 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 the proponent intends following for the construction phase.
» 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

» The proponent should seek to develop 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; » The local municipality, in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project. 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 in the area, specifically local communities in Prieska. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks.

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)	Medium Term for community as a whole (3) 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 (27)** **Moderate-High for specific individuals who may be affected by STD's etc. (57)**	**Low for the community as a whole (24)** **Moderate-High for specific individuals who may be affected by STD's etc. (51)**
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:

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;
» The proponent should consider the establishment of a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers;
» The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation;
» The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
» The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
» The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
» As per the agreement with the local farmers in the area, no construction workers, will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.

Cumulative impacts:

Impacts on family and community relations that may, in some cases, persist for a long period. 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. The development of other solar energy projects in the area may exacerbate these impacts.

Residual impacts:

Community members affected by STDs etc. See cumulative impacts.

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 Garob Wind Farm may, on its' own, not result in influx of significant numbers of job seekers to Prieska, the establishment of a number of wind and other renewable energy projects in the area has the potential to 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 affect the local community. There is also a concern that some of these job seekers may not leave town immediately and, in some cases, may stay indefinitely.

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Minor for the community as a whole (2) High-Very High for specific individuals who may be affected by STDs etc. (10)	Minor for community as a whole (2) 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 (27)** **Medium -High for specific individuals who may be affected by STDs etc. (54)**	**Low for the community as a whole (27)** **Medium-High for specific individuals who may be affected by STDs etc. (51)**
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 almost impossible to stop people from coming to the area in search of a job, specifically given that the district municipality and local municipality have identified renewable energy as

a future growth sector. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition the proponent should:

» In consultation with the Siyathemba Local Municipality, investigate the option of establishing a monitoring forum (see above) 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 solar energy projects in the area;
» Implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in Prieska and other towns in the Siyathemba Local Municipality.

Cumulative impacts:

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

Residual impacts:

See cumulative impacts.

Nature: Potential impact on local farmers associated with loss of farm labour to the construction 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 renewable energy companies during the construction phase. 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 Garob Wind Farm on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the 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. In addition, the findings of the SIA indicate that the farming activities in the area are not labour intensive.

	Without Mitigation	***With Mitigation***
Extent	Local and Regional (2)	Local and Regional (1)
Duration	Medium Term (3) (Assumed that farm labour can be replaced)	Medium Term (3) (Assumed that farm labour can be replaced)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, if farm workers return of are replaced	Yes, if farm workers return of are replaced
Irreplaceable loss of resources?	No	No

Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

While the proponent can liaise with local farmers in the area and take steps not to employ local farm worker were possible, it is not possible to prevent farm workers from applying for work. There are therefore no recommended mitigation measures. Also it is assumed that farm labour can be replaced. The impacts would therefore be temporary.

Farm workers who apply for construction related work should also be informed that the nature of the work is temporary. In addition they should be informed of the potential negative consequences of their actions, which include the potential loss of their permanent farm job.

Cumulative impacts:
Impacts on farm operations due to loss of experienced farm labour

Residual impacts:
Increase in unemployment amongst local farm workers who are not rehired once construction worker comes to an end. On positive side, may result in increased skills for local farm workers and improve their economic mobility.

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

The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged. The local farm owners in the area who were interviewed indicated that stock theft was currently not a major concern. However, concerns were raised regarding the presence of construction workers in the area. As indicated above, all of the local farmers in the area noted that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	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:

The mitigation measures that can be considered to address the potential impact on livestock, game, and farm infrastructure include:

- The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase;
- The proponent should investigate the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. Should such a MF be required it should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent, the neighbouring landowners and the contractors before the contractors move onto site;
- The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below);
- The EMP must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
- Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;
- The housing of construction workers on the site should be limited to security personnel.

***Cumulative impacts*:**

No**,** provided losses are compensated for

***Residual impacts*:**

See cumulative impacts.

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

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

The owner of Nels Poortje (Mr Fourie) did however indicate that the incidence of veld fires in the area was low. In addition, the threat of veld fires was largely confined to the grass veld

areas. The low, Karoo scrub areas where not prone to fires. Mr Fourie therefore indicated that the potential fire risk was likely to be low. However, he noted that appropriate precautions need to be taken by the contractor during the construction phase.

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

Mitigation:

As indicated previously, the proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes losses associated veld fires. In addition, the potential increased risk of veld fires can be effectively mitigated. Mitigation measures include:

- Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- No smoking on the site, except in designated areas should be permitted.
- Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months.
- Contractor should provide adequate fire fighting equipment on-site.
- Contractor should provide fire-fighting training to selected construction staff.
- 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.

In addition, the landowners and developers should also ensure that they join the local fire protection agency.

***Cumulative impacts*:**
No, provided losses are compensated for.

Residual impacts:
Potential loss of income and impact on livelihoods and economic viability of affected farms.

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site		
	Without Mitigation	***With Mitigation***
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

As indicated earlier, the proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes damage to local roads by construction vehicles. In addition, the potential impacts associated with heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

- Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.
- The contractor must ensure that all damage caused to local farm roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor.
- Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
- All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.

In addition, it is recommended that the proponent investigate the option of using rail to transport materials and equipment from Port Elizabeth to Prieska via De Aar.

***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*:**
Reduced quality of road surfaces and impact on road users

Nature: damage and loss of farmlands for future farming activities

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

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated or compensation is not paid (5)	Medium Term if damaged areas are rehabilitated (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (28)**
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 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 a suitably qualified ecologist.
» 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 farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated.

Residual impacts:

See cumulative impacts.

Impact table summarising the significance of Social Impacts during the Operational Phase (with and without mitigation)

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

Based on information from other wind energy facilities the establishment of a 140MW wind energy facility will create approximately 7 permanent and 9 temporary employment opportunities. The operational phase is expected to last 20 years. The employment opportunities are therefore limited. 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 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 people from outside the area.

	Without Mitigation	***With Enhancement***
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:

The measures listed to enhance local employment and business opportunities during the construction phase also apply to the operational phase. In addition:

» The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of locals employed during the operational phase of the project.
» The proponent, in consultation with the Siyathemba Local Municipality, should investigate the opportunities for establishing a Community 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:
See cumulative impacts

Nature: Community benefits during the construction phase from the implementation of a community trust

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. The proponent has indicated that they are committed to establishment of a community trust.

Community trusts provide an opportunity to generate a reliable and steady revenue stream over a 20 year period. This revenue can be used to fund development initiatives in the area and support the local economic and community development. The 20 year timeframe also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed wind farm can be used to support a number of social and economic initiatives in the area.

	Without Mitigation	***With Enhancement***
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
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:

- The proponent in consultation with the SLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community;
- The proponent in consultation with the SLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the WEF are managed for benefit of the community as a whole and not individuals within the community

***Cumulative impacts*:**
Promotion of social and economic development and improvement in the overall well-being of the community

Residual impacts:
See cumulative impacts

Nature: Promotion of clean, renewable energy		
	Without Mitigation	***With Enhancement***
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 represents an enhancement measure in itself. In order to maximise the benefits of the proposed project the proponent should:

- Use the project to promote and increase the contribution of renewable energy to the national energy supply.
- 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:
See cumulative impacts

Nature: Potential impacts on family structures, social networks and community services associated with the influx of job seekers

While the proposed wind energy facility on its own is unlikely to result in a significant influx of job seekers during the operational phase, the proposed establishment of a number of renewable energy projects in and around Prieska is likely to attract job seekers to the area. These issues are similar to the concerns associated with the influx of jobs seekers during the construction phase.

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Low for the community as a	Minor for community as a

	whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	whole (2) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Medium** for the community as a whole (33) **Medium -High** for specific individuals who may be affected by STDs etc. (51)	**Low** for the community as a whole (27) **Medium-High** for specific individuals who may be affected by STDs etc. (51)
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 work, specifically given that the PKSDM and SLM have identified renewable energy as key growth sector. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition the proponent should:

- In consultation with the SLM, should investigate the option of establishing a MF (see above) to monitor and identify potential problems that may arise due to the influx of job seekers to the area. The MF should also include the other proponents of solar energy projects in the area;
- Implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in Prieska and other local towns in the SLM.

Cumulative impacts:

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

Residual impacts:

See cumulative impacts.

Nature: Potential 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 renewable 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.

	Without Mitigation	***With Mitigation***
Extent	Local and Regional (3)	Local and Regional (2)
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 (24)**
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 the proponent 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:
See cumulative impacts.

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

	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (56)**	**Medium (56)**
Status	Negative	Negative

Reversibility	Yes, wind facility can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: The recommendations contained in the VIA should be implemented		
Cumulative impacts: Potential impact on current rural sense of place		
***Residual impacts*:** See cumulative impacts		

Nature: Potential impact of the facility on local tourism

The Northern Cape PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile ecosystems and vulnerability to climatic variation. The document also indicates that due to the province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Therefore caution must be taken to ensure that the development of renewable energy projects, such as the proposed wind farm, do not impact negatively on the tourism potential of the Province.

	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/Mitigation:

The recommendations contained in the VIA should be implemented.

In terms of efforts to enhance the proposed benefits to tourism:

» The proponent should liaise with representatives from the Siyathemba Local Municipality and local tourism representatives to raise awareness of the proposed facility. » The proponent should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.
Cumulative impacts: Potential negative and or positive impact on tourism in the Sitathemba Local Municipality Area.
Residual impacts: See cumulative impacts

Implications for Project Implementation

» The findings of the SIA undertaken for the proposed **Garob Wind Farm** indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» Potential negative impacts can be reduced to low significance through the implementation of appropriate mitigation measures.

7.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[13]. A wind farm is proposed on the farm immediately to the west of the Garob Wind Farm (on the Farm Vogelstruis Bult and Nels Poortje 7/102 and 8/103). Three solar energy facilities are also proposed in the immediate vicinity of the site. The cumulative impact of the proposed facility in addition to these other proposed facilities is discussed below.

» Cumulative *ecological impacts* – cumulative impacts on ecology relate largely to the impacts at a regional level rather than at a site-specific level. Impacts on a plant/animal species or vegetation/habitat type at the site could have an impact on the conservation status of these species at a regional level. Therefore, it is important to consider the broader impact within the region rather than at the site specific level. This could be particularly important if identified Red List or protected species are impacted by this and other proposed developments in the region. The potential for cumulative impacts on vegetation loss will be quite low on account of the small development footprint of the facility in relation to the overwhelmingly intact nature of the surrounding landscape. However, disturbance of vegetation should all the proposed facilities within the broader

[13] Definition as provided by DEA in the EIA Regulations.

area be developed could increase the cumulative impact with regard to the loss of vegetation and the establishment of alien invasive species such as *Prosopis*.

» Cumulative *avifauna impacts* - collision rates of birds with turbines and/or power lines may appear relatively low in many instances. However, cumulative effects over time, especially when applied to large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable conservation significance. Furthermore, when viewed in isolation, one renewable energy facility may pose only a limited threat to the avifauna of the region. However, in combination they may result in the formation of significant barriers to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become repeated arrays of renewable energy facility components spread across foraging areas and/or flight paths of priority species. In addition to the other proposed facilities the proposed Garob Wind Farm would add to habitat loss in the area. However, on a landscape level this is believed to be of low significance based on the results of the pre-construction monitoring to date.

» Cumulative *soils and agricultural potential impacts* - although the impact of soil removal for the proposed activity has a moderate significance, the cumulative impact of soil removal and earthworks in the area is considered low due to the localised and scattered nature of the proposed activity and the largely undeveloped nature of the broader area.

» Cumulative impacts *on heritage and fossil resources* – Increased pressure on heritage and palaeontological resources through the destruction of these resources. With numerous facilities within an area, the potential also exists for impacts on the cultural landscape and cultural heritage of an area. Due to the fact that the visual character of the area has already been negatively impacted by existing power lines, mines and associated infrastructure, the significance of the potential cumulative impacts in this regard is expected to be low.

» Cumulative *noise impacts* - the impact of construction and operation activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. This is however considered to be of low significance given the low number of noise sensitive receptors in the area.

» Cumulative *visual impacts* - The construction of the turbines together with the roads and other ancillary infrastructure will increase the cumulative visual impact within the region. This is specifically relevant in light of other proposed renewable energy facilities located in the proximity of the site. These will also increase the industrial type infrastructure within the area. Cumulative visual

impacts of residents within the area is considered to be low given the low number of sensitive receptors in the area. In addition, the visual character of the area has already been negatively impacted by the existing power lines associated with the Cuprum and Kronos substations located to the west and south west of the site respectively. The visual character of the area has also been negatively impacted by the overburden and slimes dams associated with the historic mining in the area. The significance of the potential cumulative visual impacts is therefore rated to be low.

» Cumulative *social impacts* - The proposed establishment of multiple renewable energy facilities in the area will result in an increase the cumulative social impacts within the area. The cumulative negative impacts will be linked to combined visibility (more than one renewable energy facility visible from one location, sequential visibility (more than one renewable energy visible along a single journey), and the change in land use and character of the area (confined to the area affected by the proposed renewable energy facilities). The proposed Garob Wind Farm and establishment of the other renewable energy projects in the area also has the potential to result in significant positive cumulative socio-economic impacts for the Siyathemba Local Municipality. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. The significance of this impact is rated as High positive with enhancement.

Cumulative effects have also been considered for each potential impact within the detailed specialist studies, where applicable (Refer to Appendices F – N).

ASSESSMENT OF POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED GAROB POWER LINE CHAPTER 8

This chapter serves to determine the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) associated with the development of the proposed **Garob Wind Farm 132 kV power line** and associated infrastructure.

Two options are being considered as follows (see also Figure 1.1 below):

- **Option 1:** Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
- **Option 2:** would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
  - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
  - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

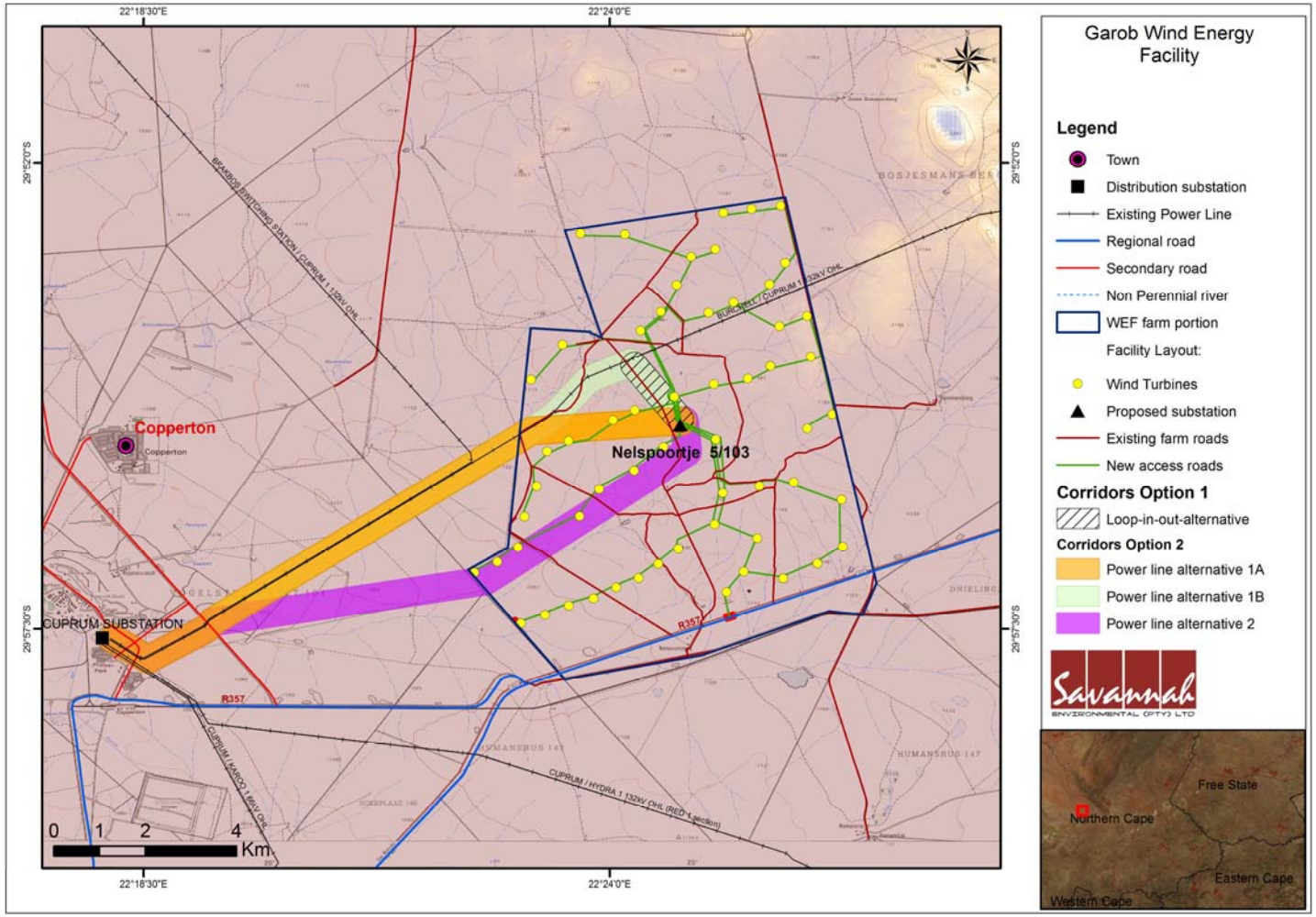


Figure 8.1: Preliminary layout showing the study area as well as proposed power lines for the Garob Wind Farm located on portion 5 of the farm Nelspoortje 103, within the Siyathemba Local Municipality (Northern Cape)

The development of the Garob power line will comprise the following phases:

» *Pre-Construction and Construction* – will include preconstruction surveys; site preparation; establishment of the access road, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a stormwater management plan.
» *Operation* – will include operation of the power line.
» *Decommissioning* – depending on the economic viability of the associated wind farm, the length of the operational phase of the power line may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately and in further detail within this chapter.

8.1. Assessment of Alternatives

In accordance with the requirements of the EIA Regulations[9], alternatives are required to be considered within the EIA process, details of alternatives considered for the broader development have been discussed in the Chapter 7. However, this chapter assesses the potential impacts associated with the power line options/alternatives. The following power line options are proposed.

Two options for grid connection (power line routes)

» **Option 1:** Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
» **Option 2:** would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
  - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
  - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

[9] GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity.

8.2. Areas of disturbance associated with the proposed Garob Power Line

In order to assess the impacts associated with the proposed power line, it is necessary to understand the extent of the affected area. The affected area primarily includes the footprint of the power line towers and associated access roads. The servitude of this power line will be approximately 41.8 ha for the longest power line option (13 500 m x 31 m). However, only an area approximately 10.8 ha (13 500 m X 8 m) will be disturbed during the construction of the power line.

8.3. Assessment of the Potential Impacts associated with the Construction and Operation Phases of the Power Line associated with the Garob Wind Energy Facility

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation of the proposed 132 kV power line associated with the Garob Wind Farm.

Issues were assessed in terms of the criteria detailed in Chapter 4. The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted.

8.3.1 Assessment of Potential Impacts on Ecology

There are two major ways that a power line may impact on the ecological environment: a) through direct impacts on individual organisms and b) through impacts on habitat structure and functioning.

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

Broad scale mapping, desktop assessments, detailed mapping from aerial photography and detailed fieldwork were used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. Perennial and non-perennial rivers, streams and drainage lines: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;

The drainage lines are the only feature which are considered to be Very High sensitivity, but it is possible to straddle to drainage lines should they need to be crossed by the power lines. No power line towers should be located within such areas.

Impact table summarising the significance of impacts on the vegetation and general ecology (with and without mitigation)

Impact Nature: Impacts on vegetation and protected plant species may occur due to the construction of the power line.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources	No	
Can impacts be mitigated?	To a large extent	
Mitigation » The final power line support structure locations and any access roads required for construction should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction. » Disturbance resulting from construction is likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion along the power line route should be implemented as part of the EMP for the development.		
Cumulative Impacts The potential for cumulative impacts is quite low on account of the low footprint the power line is likely to generate.		
Residual Impacts Provided that suitable mitigation measures are implemented residual impacts would be very low.		

Impact Nature: Alien plants are likely to invade the site as a result of disturbance created during construction		
	Without Mitigation	***With Mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (36)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation » Vegetation clearing along the power line route to be kept to a minimum. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. » Alien management plan should be developed as part of the EMP for the development. It should aim to address alien plant problems within the whole site, not just the development footprint.		
Cumulative Impacts If alien abundance, particularly *Prosopis* increases a lot then some impact on hydrology and the ecological functioning the area can be expected.		
Residual Impacts If alien species at the site are controlled, then there will be very little residual impact		

Impact Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation » Vegetation disturbance should be kept to a minimum, while shrubs and trees may need to be removed from the power line path, the ground layer should be left intact as » Any service roads required should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.		

» Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
Cumulative Impacts Higher sediment loads in rivers and streams will affect in-stream vegetation and biota
Residual Impacts If erosion at the site is controlled, then there will be no residual impact

Comparative Assessment of Power line Alternatives

All of the impacts associated with the power line options can be reduced to a low or moderate level through mitigation and there are no impacts present which are likely to represent a red-flag for the development. Some impacts such as habitat loss for fauna and flora cannot be avoided, but overall the significance of these impacts is not high on account of the low overall sensitivity of the receiving environment. Power line Option 1 would be the most preferred option as it will be the shortest power line route. From Option 2, Alternative 1A and 1B are also preferred they join the existing power line for most of its route. For comparative purposes, the impact associated with the other two alternatives is provided in the summary table below.

Impact	Option 1		Option 2					
			Alternative 1A		Alternative 1B		Alternative 2 (Least)	
	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation
Vegetation and listed species	Low (14)	Low (6)	Medium (40)	Low (24)	Medium (48)	Low (24)	Medium (55)	Medium (33)
Alien plant invasion risk	Low (14)	Low (6)	Medium (36)	Low (15)	Medium (36)	Low (15)	Medium (36)	Low (15)
Increased erosion risk	Low (14)	Low (6)	Medium (33)	Low (12)	Medium (44)	Low (18)	Medium (44)	Low (18)

Implications for Project Implementation

» Power line Option 1 is the most preferred route as it is the shortest
» The final power line support structure locations and any access roads required for construction should be surveyed by a suitably qualified ecologist for species suitable for search and rescue, which should be translocated prior to the commencement of construction.

8.3.2 Assessment of Potential Impacts on Avifauna

Overhead power lines pose a collision and possibly an electrocution threat to certain bird species. In addition, the construction and maintenance of the power lines will result in some disturbance and habitat destruction.

Collision with power lines is one of the biggest single threats facing birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. The collision risk of the proposed power lines has been assessed below.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The larger bird species are most affected since they are most capable of bridging critical clearances on hardware. The electrocution risk of the proposed 132kV and smaller lines has been assessed below.

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the leveling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimise the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

Impact table summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Collision and electrocution of birds on overhead power lines
These two impacts are likely to be of medium significance if not correctly mitigated. In this arid area, overhead power lines stand out vertically and therefore present large obstacles to birds in flight (thereby increasing the likelihood of collision) and present

suitable perching substrate where large trees are virtually absent (thereby increasing the risk of electrocution). Fortunately this impact is relatively easily mitigated, particularly in the case of electrocution.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	**48 (Medium)**	**24 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – birds are killed	Low – birds are killed
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Collision:

» The high risk sections of power line should be identified during a final avifaunal walk through for the site once all final positions of infrastructure have been finalised.
» High risk sections of the 132kV power line connecting to the grid must be installed with an effective Eskom approved line marking device. The best device available at the time of construction must be used. These devices should be installed on the earth wires at a spacing of no more than 5m, alternating a dark and a light colour.
» All power lines on site connecting turbines should be buried.

Electrocution:

» Only an Eskom approved bird friendly pylon structure must be used for the connection to the grid. It is recommended that the steel monopole, with Bird Perch be used.
» All power lines linking turbines on site should be buried.

Cumulative impacts:

The cumulative impacts of overhead power lines on certain bird species in the arid parts of South Africa are substantial. Bustards and cranes (collision) and large raptors (electrocution) have been heavily impacted upon by power lines in these areas. As a result some of these species are unlikely to be able to sustain too much more additional mortality. Every effort should therefore be made to ensure that this proposed facility does not impact unduly upon these birds. This can be achieved through implementing the above mitigation measures.

Residual Impacts:

Once the power lines are decommissioned the impact would cease. However the birds that may have been killed by the power lines can be considered a residual impact since they cannot be recovered.

Comparative Assessment of Power line Alternatives

From an avifaunal perspective it makes good sense to group infrastructure in one part of the landscape rather than scattering them around. In addition it is believed that multiple power lines are more visible to birds in flight than single lines (APLIC 1994), thereby partially mitigating for the impact of collision.

The Option 1 is therefore the most preferred route from an avifaunal perspective as it requires the least new power line.

From Option 2, Alternative 1A and 1 B are also preferred they join the existing power line for most of its route, and avoids the low lying sensitive areas that are traversed by Alternative 2. Alternative 2 is not preferred as it runs close to the largest drainage line on site and does not take advantage of following the existing power line route.

None of the routes are fatally flawed from an avifaunal perspective. No particularly sensitive areas exist along the routes from the site to Cuprum.

Implications for Project Implementation

» Option 1 is the most preferred route from an avifaunal perspective as it requires the least new power line. However, should it not be available Option 2 two Alternative 1 is still acceptable.
» Conduct avifaunal walk down on final 132kV power line route to identify high risk sections of power line for collision mitigation.
» Ensure that pylon structure used for 132kV power line is bird friendly

8.3.4 Assessment of Potential Impacts on Bats

There is no evidence to suggest that bats are affected by power lines in any way. Therefore, the alternative power line options were not assessed (see Appendix H for the Bat Impact Assessment Study).

8.3.5 Assessment of Potential Impacts on Soils

The environmental impact assessment aimed to evaluate the impact that the proposed power line will have on soils and attempted to provide mitigating measures to minimise the impact.

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

Nature: Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**

Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. » Care should also be taken to control and contain storm water run-off. » Rehabilitate construction sites by establishing it with indigenous grasses like *Anthephora pubescens*, *Cenchrus ciliaris*, *Eragrostis curvula*, etc.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Nature: Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Construction and other activities must be communicated and co-ordinated with affected landowners in order for them to properly plan their management activities.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Comparative Assessment of Power line Alternatives

From a soil perspective and the distances the power lines must cross over the site, the power line Option 1 and from Option 2 sub alternative 1(a) and 1(b) are the better options. Power line Option 1 is the shortest and has the last impacts.

Implications for Project Implementation

» The soils in the area are susceptible to both water and wind erosion, although the susceptibility is categorised as low to medium
» Erosion control measures need to be put in place.

8.3.6 Assessment of Potential Impacts on Heritage Sites and Palaeontology

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may impact in the following manner: Southern power line corridor on find spot 16 and 17***.***		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**45 (Medium)**	**24 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The sites should be monitored during construction. Alternatively, the general location should be demarcated to avoid impact on the sites.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of Archaeological record of the area.		

Comparative Assessment of Power line Alternatives

Find spot 16 and 17 might be impacted by power line Option 2's Alternative 2. These sites are sufficiently recorded and no further mitigation will be necessary as the impact of the pylon positions are considered to be extremely low and

comparative material will remain on the unaffected areas of the site. In this regard all power line options are acceptable from an heritage point of view.

Implications for Project Implementation

» All pans must be avoided with at least a hundred meter buffer zone.
» On the farm Vogelstruisbult the following sites have been identified as **no go** areas. VGSTR4, NPRT4 & VGSTR12 (refer to Wiltshire 2011).
» When the route alignment have been finalised the pylon positions must be subjected to a "walk down".

8.3.7 Assessment of Potential Visual Impacts

The potential visual exposure of the power line options within an offset of 2km on either side of the power line alignment is shown on Figures 7.9 and 7.10. Due to the flat topography, all alignments will be visually exposed to almost the entire area within the above 2km offset. The northern corridor (Option 1 and Alternative 1(a) and Alternative 1(b) of Option 2) will be exposed to a single homestead (on the proposed development site), while the southern corridor (Alternative 2) will not be exposed to any.

The low occurrence of visual receptors within the viewshed of the power line, as well as the fact that the existing line will absorb the visual impact to some extent within the broader area, lowers the probability of this impact occurring. The anticipated visual impact resulting from this infrastructure is likely to be of low significance. No mitigation of this impact is possible, but measures are recommended as best practice.

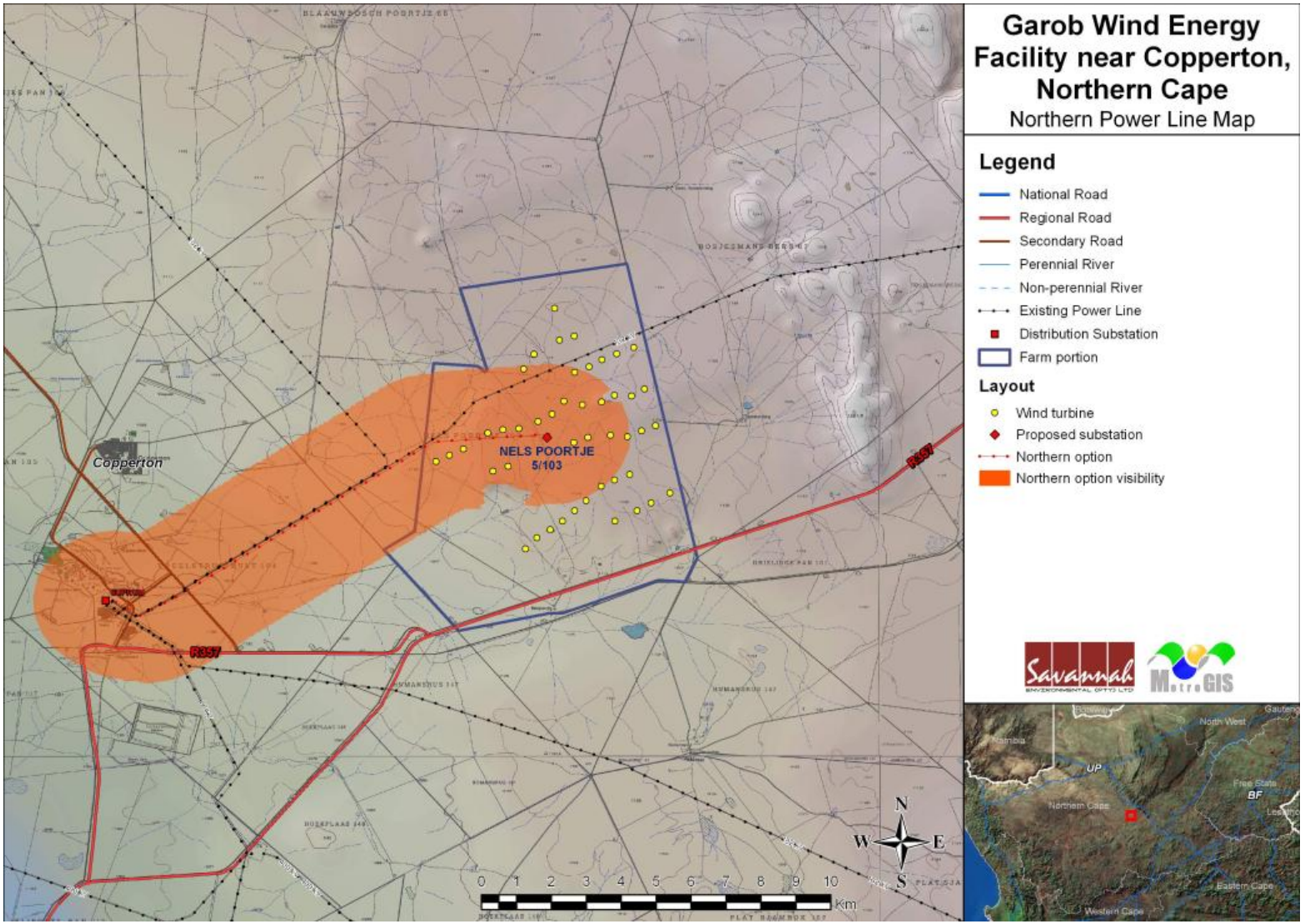


Figure 8.3: Potential visual exposure of the northern corridor (Option 1 and Alternative 1(a) and Alternative 1(b) of Option 2)

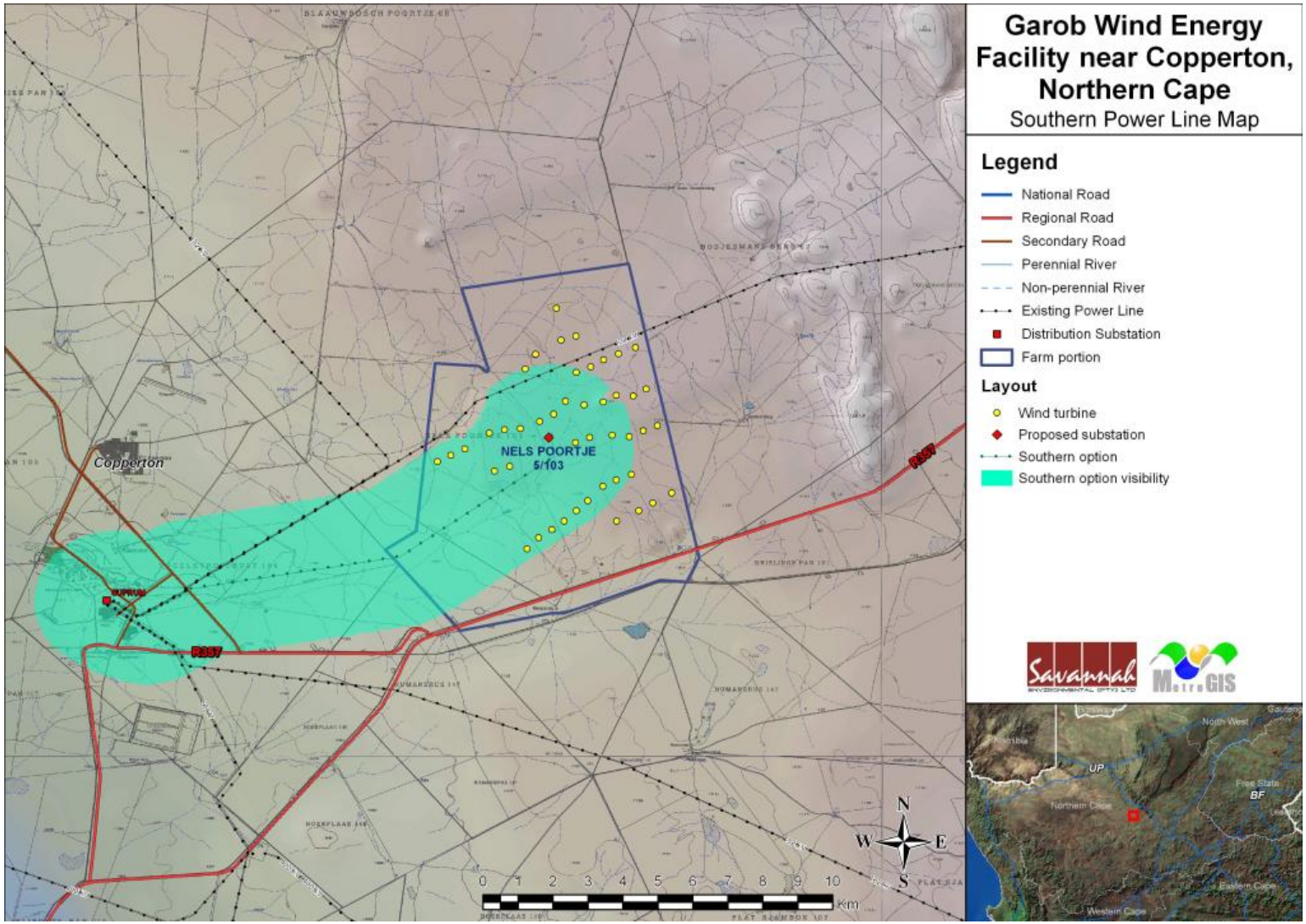


Figure 8.4: Potential visual exposure of the southern corridor (Alternative 2 of Option 2)

Impact tables summarising the significance of visual impacts (with and without mitigation)

Nature of Impact: Visual impact of the overhead power line on sensitive visual receptors in close proximity thereto The low occurrence of visual receptors within the viewshed of the power line, as well as the fact that the existing line will absorb the visual impact to some extent, lowers the probability of this impact occurring. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance. No mitigation of this impact is possible, but measures are recommended as best practice.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(28)**	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 / Management: Construction: » Rehabilitation of all construction areas, including the power line servitude. » Ensure that vegetation is not cleared unnecessarily. Operation: » Maintenance of servitude. Decommissioning: » Removal of infrastructure not required for post decommissioning use and rehabilitation of the servitude areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the overhead power lines will increase the cumulative visual impact of buildings and industrial type infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area.		
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.		

Comparative Assessment of Power line Alternatives

Of relevance is that the northern corridor follows an existing line, while the southern corridor does not. From a visual perspective, the consolidation and concentration of infrastructure is favoured, as this limits the extent of visual exposure to an area within which some visual disturbance is already present. In

this regard, power lines in the northern corridor (Option 1 and Option 2 sub alternative 1A and 1A) is favoured from a visual perspective.

Implications for Project Implementation

» Consolidate infrastructure and make use of already disturbed sites rather than pristine areas.
» It is not possible to mitigate visual impacts associated with the proposed power line.

8.3.8 Assessment of Potential Social Impacts

Potential impacts associated with the power line are expected during both the construction and operational phases.

Impact table summarising the significance of Social Impacts during the Construction Phase (with and without mitigation)

Nature: Potential visual impact and impact on sense of place associated with power lines		
	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	
***Mitigation*:** The recommendations contained in the VIA should be implemented. The measures listed above to address the potential impacts associated with the construction phase also apply to the construction of the power line		
***Cumulative impacts*:** Limited visual and impact on sense of place		
***Residual impacts*:** See cumulative impacts		

Comparative Assessment of Power line Alternatives

The visual impact assessment notes that due to the flat topography, both options will be visually exposed to almost the entire area within the above 2km offset.

However, Option 1 due to its length will have the least impact. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance.

The findings of the Social Impact Assessment indicate that the due to the shorter length, and the containment of this option within the boundaries of the wind farm, the social impacts associated with Option 1 would be lower than those associated with Option 2 (Alternative 1 and 2). **Option 1** is therefore the preferred alternative.

Implications for Project Implementation

» **Option 1** is the preferred alternative for implementation from a social perspective.
» The anticipated visual impact resulting from this infrastructure is likely to be of low significance

8.3.9 Assessment of Potential Noise Impacts

No impacts from a noise point of view are anticipated for the power lines (see Appendix J for the Noise Impact Assessment Study).

8.4. Comparative Assessment of Alternatives

The findings of the specialist studies regarding preference of the power line alternatives is summarised in the table below.

	Preferred Power line Route
Ecology	Option 1, however from Option 2, Alternative 1A and 1B are acceptable
Avifauna	Option 1, however from Option 2, Alternative 1A and 1B are acceptable
Bats	No preference (no impacts anticipated from power lines)
Geology	Option 1, however from Option 2, Alternative 1A and 1B are acceptable
Heritage and Palaeontology	All power line options are acceptable
Visual	Option 1 and Option 2 sub alternative 1A and 1A
Noise	No preference (no impacts anticipated from power lines)
Social	Option 1, however from Option 2, Alternative 1A and 1B are acceptable

Therefore the preferred route for the power line alternative is Option 1. This is due to the short length of this option as well as the fact that it will be entirely contained within the boundaries of the wind farm, therefore consolidating impacts associated with the proposed project. The route meets the acceptance level for environmental

impacts. Garob Wind Farm (Pty) Ltd will ensure that impacts are minimised to an acceptable level. This can be managed through the implementation of an Environmental Management Plan. However, the other power line options are also not fatally flawed and should power line Option 1 not be available alternative 1A and 1B of Option 2 are also preferred.

8.5. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[10]. A wind farm is proposed on the farm immediately to the west of the Garob Wind Farm (on the Farm Vogelstruis Bult and Nels Poortje 7/102 and 8/103). Three solar energy facilities are also proposed in the immediate vicinity of the site. The cumulative impact of the proposed power line in addition to these other proposed facilities is discussed below.

» Cumulative *ecological impacts* – cumulative impacts on ecology relate largely to the impacts at a regional level rather than at a site-specific level. Impacts on a plant/animal species or vegetation/habitat type at the site could have an impact on the conservation status of these species at a regional level. Therefore, it is important to consider the broader impact within the region rather than at the site specific level. This could be particularly important if identified Red List or protected species are impacted by this and other proposed developments in the region. The potential for cumulative impacts on vegetation loss will be quite low on account of the small development footprint of the facility in relation to the overwhelmingly intact nature of the surrounding landscape. However, disturbance of vegetation should all the proposed facilities within the broader area be developed could increase the cumulative impact with regard to the loss of vegetation and the establishment of alien invasive species such as *Prosopis*.

» Cumulative *avifauna impacts* – Cumulative impact from an avifauna point of view will relate to the combined habitat loss due to power line construction. This is however considered to be of low significance as the power line alternative follow the existing power line.

» Cumulative *soils and agricultural potential impacts* - although the impact of soil removal for the proposed activity has a moderate significance, the cumulative impact of soil removal and earthworks in the area is considered low due to the localised and scattered nature of the proposed activity and the largely undeveloped nature of the broader area.

[10] Definition as provided by DEA in the EIA Regulations.

» Cumulative impacts *on heritage and fossil resources* – Increased pressure on heritage and palaeontological resources through the destruction of these resources.

» Cumulative *visual impacts* - The construction of the power lines will increase the cumulative visual impact within the region. However, as the power line follows an existing power line this impact is considered to be of low significance

» Cumulative *social impacts* - The proposed establishment of multiple renewable energy facilities in the area as well as the associated power lines will result in an increase the cumulative social impacts within the area. The cumulative negative impacts will be linked to combined visibility (more than one renewable energy facility visible from one location, sequential visibility (more than one renewable energy visible along a single journey), and the change in land use and character of the area (confined to the area affected by the proposed renewable energy facilities). The proposed Garob Wind Farm and establishment of the other renewable energy projects in the area also has the potential to result in significant positive cumulative socio-economic impacts for the Siyathemba Local Municipality. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. The significance of this impact is rated as High positive with enhancement.

Cumulative effects have also been considered for each potential impact within the detailed specialist studies, where applicable (Refer to Appendices F – N).

CONCLUSIONS AND RECOMMENDATIONS: PROPOSED GAROB WIND FARM & ASSOCIATED INFRASTRUCTURE CHAPTER 9

Garob Wind Farm (Pty) Limited is proposing the establishment of a commercial wind energy facility and associated infrastructure on an identified site located near Copperton in the Northern Cape Province of South Africa. The proposed site is located within the Siyathemba Local Municipality (within the Pixley ka Seme District Municipality), approximately 10 km east of the town of Copperton, and ~35 km south west of the town of Prieska. This proposed project will be referred to as the **Garob Wind Farm**.

Infrastructure associated with the **Garob Wind Energy Facility** will include:

» 58 **wind turbines** with a hub height of up to 100m and a rotor diameter of up to 120m. The facility will have a total generation capacity of up to 140 MW.
» Concrete **foundations** to support the turbines.
» **Cabling** between the turbines, to be laid underground where practical so to connect to the on-site substation.
» Internal **access roads** to each turbine (approximately 7 m wide) linking the wind turbines and other infrastructure on the site. Existing roads will be used where possible.
» An on-site substation to facilitate the connection between the wind energy facility and the electricity grid.
» New 132 kV overhead power line. Two options are being considered as follows (see also Figure 1.1 below) :
  * Option 1: Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
  * Option 2: would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
    - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)
    - **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

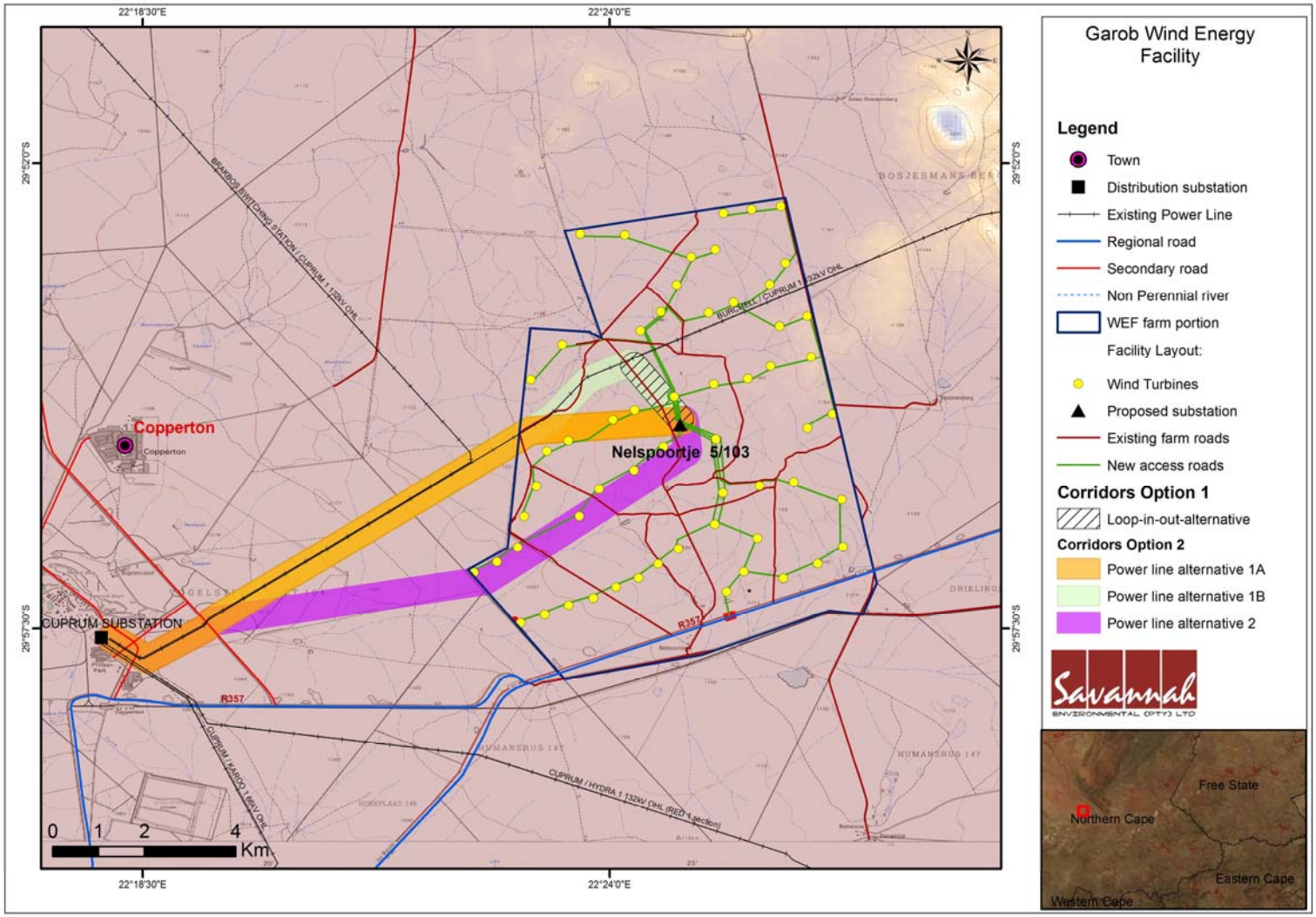


Figure 9.1: Preliminary layout showing the study area as well as proposed infrastructure for the Garob Wind Farm located on portion 5 of the farm Nelspoortje 103, within the Siyathemba Local Municipality (Northern Cape)

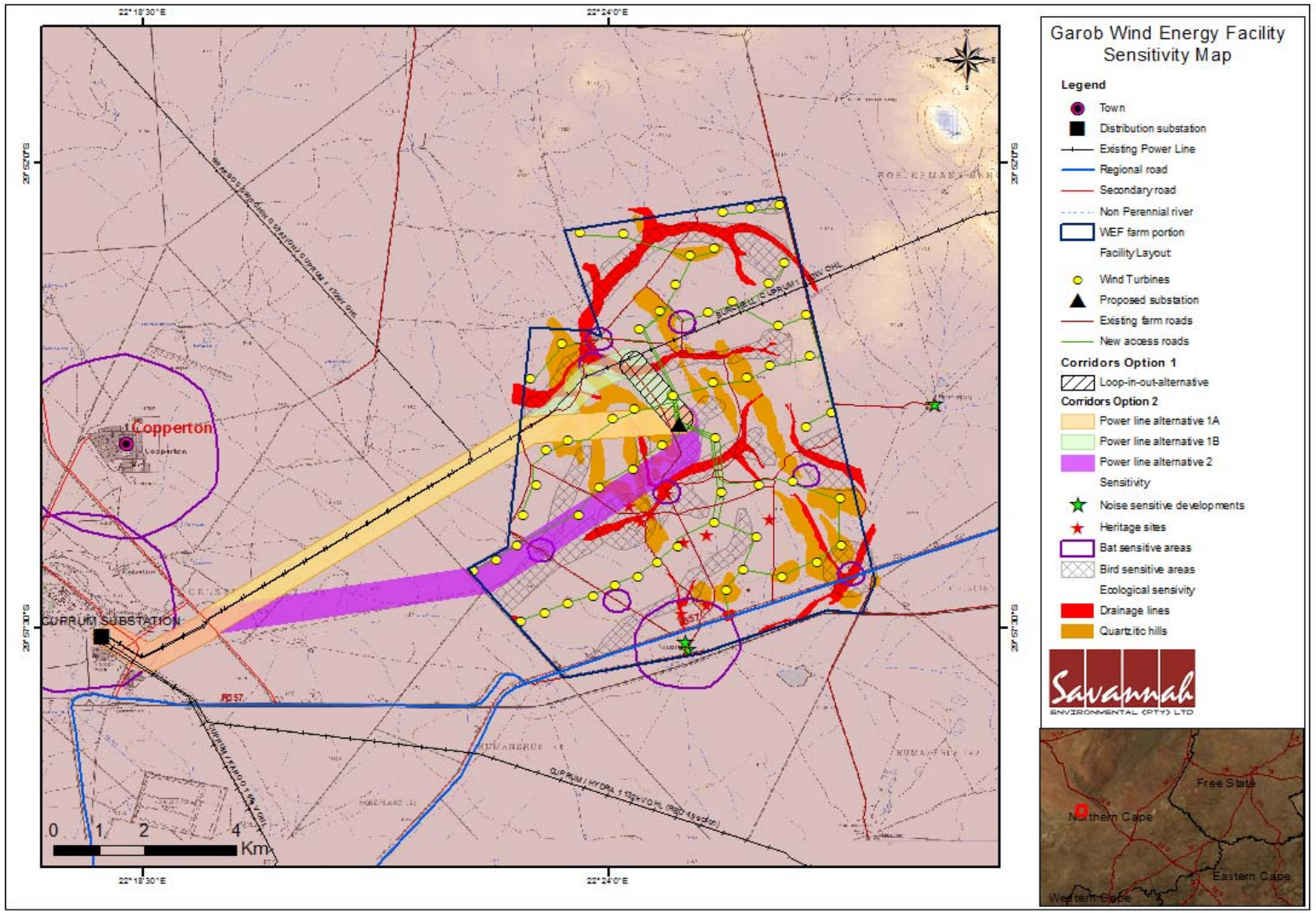


Figure 9.2: Sensitivity map illustrating the sensitive areas across the site

The EIA Phase for the proposed Garob Wind Energy Facility and associated power line 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 EIA Phase aimed to achieve the following:

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

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - N provide a detailed assessment of the environmental impacts on the social and biophysical environment of the proposed project. This chapter concludes the EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the **Garob Wind Farm**. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The majority of impacts identified through the EIA are of moderate to low significance. In summary, the most significant environmental impacts associated with the proposed project, as identified through the EIA include:

» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the power line.
» Impacts on the social environment.

Table 9.1 below gives a summary of the potential impacts identified and assessed through the EIA process as well as their impact rating before and after mitigation

Table 9.1: Summary of impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Potential impacts on Ecology		
Impacts on vegetation and protected plant species	Medium - High	Medium
Increased alien plant invasion	Medium	Low
Habitat loss for fauna	Medium	Low
Reduced landscape connectivity	Medium	Medium
Direct Faunal Impacts	Medium	Low
Increased erosion risk	Medium	Low
Impacts on vegetation and protected plant species may occur due to the construction of the power line	Medium	Low
Alien plants are likely to invade the site as a result of disturbance created during construction of the power line	Medium	Low
Increased erosion risk as a result of soil disturbance and loss of vegetation cover during construction of the power line	Medium	Low
Potential impacts on Avifauna		
Habitat destruction during construction of wind energy facility	Low	Low
Disturbance of birds during construction and maintenance of wind energy facility	Low	Low
Displacement of birds during operation of wind energy facility	Low	Low
Collision of birds with turbine blades during operation of wind energy facility	Low	Low
Habitat destruction during construction of roads	Medium	Medium
Collision and electrocution of birds on overhead power lines	Medium	Low
Potential impacts on Bats		
Roost disturbance and/or destruction due to construction activities	Low	Low
Bat fatalities due to collision or barotrauma while foraging	Medium	Medium
Disturbance to and displacement from foraging habitat due to wind turbine construction and operation	Medium	Low

Nature	Without mitigation	With mitigation
Bat fatalities due to collision or barotrauma during migration	Medium	Medium
Potential Impacts on Soils and Agricultural Potential		
Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off.	Medium	Low
Siltation of watercourses and other natural resources	Medium	Low
Dust production and dust pollution of grazing plants	Low	Low
Denudation of the soil due to construction activities and loss of carrying capacity	Medium	Low
Invasion of alien and indigenous invader plants after soil disturbance on construction sites	Medium	Low
Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site	Medium	Low
Soil erosion from road surfaces	Medium	Low
Loss of vegetation and carrying capacity	Medium	Medium
Contamination and degradation of the soil due to spillages of oil, petrol, diesel and other contaminants used by vehicles and equipment on the site or stored on the site	Low	Low
Soil erosion on construction sites during and after the construction phase of the power line due to decreased vegetation cover and increased water run-off	Medium	Low
Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site	Medium	Low
Potential impacts on Heritage Sites and Palaeontology		
Destruction of Heritage sites (sites 1 to 10)	Low	Low
Destruction of Heritage sites(find spots 1- 9, 15 and 18)	Low	Low
Potential Visual Impacts		
Visual impact on users of arterial and secondary roads in close proximity to the proposed facility	High	N/A
Visual impact on residents of homesteads and settlements in close proximity to the proposed facility	High	N/A
Visual impact on sensitive visual receptors within the region	Low	N/A

Nature	Without mitigation	With mitigation
Visual impact on the town of Copperton	High	N/A
Visual impact of onsite ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility	Low	Low
Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility.	Low	Low
Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.	Medium	Low
Visual impact of construction on sensitive visual receptors in close proximity to the proposed facility.	Medium	Low
Visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region	Low	N/A
Visual impact of the overhead power line on sensitive visual receptors in close proximity thereto	Low	N/A
Potential Noise Impacts		
Numerous simultaneous construction activities that could impact on potential sensitive receptors.	Low	Low
Numerous turbines operating simultaneously during a period when a quiet environment is desirable.	Low	Low
Potential Social Impacts (Construction)		
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	Medium	Medium
Potential impacts on family structures, social networks and community services associated with the influx of job seekers	Medium	Medium
Potential impact on local farmers associated with loss of farm labour to the construction phase	Low	Low
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Medium	Low
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence	Medium	Low

Nature	Without mitigation	With mitigation
of veld fires		
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low	Low
damage and loss of farmlands for future farming activities	Medium	Low
Creation of employment and business opportunities associated with the operational phase	Low	Low
Community benefits during the construction phase from the implementation of a community trust	Medium (positive)	High (positive)
Promotion of clean, renewable energy	Medium (positive)	Medium (positive)
Potential impacts on family structures, social networks and community services associated with the influx of job seekers	Medium	Medium
Potential impact on local farmers associated with loss of farm labour to the operational phase	Low	Low
Visual impacts associated with the proposed wind facility and the potential impact on the areas rural sense of place.	Medium	Medium
Potential impact of the facility on local tourism	Low (both positive and negative)	Low (both positive and negative)
Potential visual impact and impact on sense of place associated with power lines	Low	Low

9.1.1. Local Site-specific Impacts

The construction of the Garob Wind Farm will lead to permanent disturbance of an area of approximately 308 523m^2 in extent (i.e. 0.6% of the site). Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal power line routes and the internal access roads. From the specialist investigations undertaken for the proposed wind energy facility development site, limited areas of potential high sensitivity were identified (refer to the sensitivity map - Figure 9.2). These potentially sensitive areas include:

Drainage lines within the site

Local factors that may lead to parts of the study area having high ecological sensitivity are the presence of drainage lines on site and the potential presence of various plant and animal species of conservation concern. The drainage lines will

potentially be impacted by the proposed power line and access roads (linear infrastructure panned for the site), and not the areas to be occupied by the wind turbines. However, the power line can span the drainage line and would easily be outside the recommended 32 m buffer. Crossing of these areas by internal access roads will be very localised and can be mitigated through the implementation of appropriate measures.

In order to minimise potential impacts during construction on these potentially sensitive areas within the site, the following recommendations have been made:

» Where drainage lines are required to be crossed by access roads or impacted by other infrastructure, the relevant permits (or water use licences) must be applied for from the DWA.
» Ensure that power line towers are constructed at least 32 m from the drainage lines (i.e. span the drainage lines).
» The construction impacts must be contained to the footprint of the infrastructure.
» Only the centre line of the power line servitude should be cleared. Remaining parts of the servitude must be left intact.
» Avoid impacts on natural habitats outside the footprint of the proposed infrastructure.

With the implementation of the recommended mitigation measures, impacts will be reduced to that of medium to low significance, and are therefore considered acceptable.

Areas of natural vegetation and sensitive habitats on site

The quartzitic hills on site are considered to be high sensitivity on account of the higher flora and fauna richness associated with these areas. However, there were few threatened species recorded within this habitat through the specialist investigations. With appropriate avoidance and mitigation measures the impacts on these rocky hills could be significantly reduced to acceptable levels. The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas.

In addition, various areas were identified as potential habitats for birds and bats. These habitats will need to be avoided as far as possible. In order to minimise potential impacts during construction on these potentially sensitive areas, the following recommendations have been made:

» The construction impacts must be confirmed to the footprint of the infrastructure.
» Avoid impacts on natural habitats outside the footprint of the proposed infrastructure.
» On steeper slopes the access roads need to follow routes with lower erosion risk or contain switchbacks which reduce the slope angle and limit the slope length that water would travel before leaving the road

With the implementation of the recommended mitigation measures, impacts will be reduced to that of medium to low significance, and are therefore considered acceptable.

Heritage sites

10 sites were identified during the survey. None of these sites will be directly impacted by the proposed development. Most of the Stone Age archaeology in the study area consists of low densities of scattered (and mixed) Middle Stone Age (MSA) and Late Stone Age ((LSA) artefacts. These occurrences are documented as "find spots" and are of low significance but more substantial and higher significant MSA and LSA archaeological sites do occur, and were recorded as "sites". None of these find spots or sites will be impacted on by the proposed development. Apart from the Stone Age component a low circular stone enclosure was documented in the eastern portion of the study area. This site will not be impacted on by the proposed development.

If any archaeological material is uncovered during construction or operation a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered. In order to minimise potential impacts during construction, the following recommendations have been made:

» All pans must be avoided with at least a hundred meter buffer zone.
» When the power route alignment has been finalised, the pylon positions must be subjected to a "walk down".
» A walk-though survey of final infrastructure positions should be undertaken prior to the commencement of construction.
» Any deviation in the turbine positions must be assessed by an archaeologist.

Impacts on heritage sites are therefore expected to be of low significance and are considered acceptable.

9.1.2. Impacts on the Social Environment

Impacts on the social environment are expected during both the construction phase and the operational phase of the wind farm. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the wind farm can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

No construction crew camp will be established on the site, and construction workers will be housed in the town of Copperton and Prieska or other available/existing accommodation. Construction activities on the site will be restricted to daylight hours, and the construction phase is anticipated to extend approximately 18 months. Negative impacts during construction relate mainly to impacts due to presence of construction workers and visual impact imposed by the facility on the local environment. With the implementation of the recommended mitigation measures, negative impacts will be reduced to that of medium to low significance, and are therefore considered acceptable.

There will be a positive impact due to employment creation, which is a much needed relief by the Siyathemba Local Municipality (which has very high unemployment levels). The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase. The potential social negative impacts of the proposed development are offset by the potential positive impacts. With the implementation of the recommended enhancement measures, positive impacts will be of medium to high significance, and are therefore considered acceptable.

9.1.3. Impacts Associated with the Power Line

Potential impacts associated with the construction and operation of the proposed power line relate to impacts on ecology, avifauna and the visual quality of the area. Two options for the connection of the proposed facility to the electricity grid were considered, i.e.

- **Option 1:** Loop in and out of the existing BURCHELL/CUPRUM 132 kV line
- **Option 2:** Option 2: would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
  - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the BURCHELL/CUPRUM 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing

the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A)

* **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

From the specialist investigations undertaken, it is concluded that Option 1 is the preferred option for implementation. This is due to the short length of this option as well as the fact that it will be entirely contained within the boundaries of the wind farm, therefore consolidating impacts associated with the proposed project. The route meets the acceptance level for environmental impacts. Garob Wind Farm (Pty) Ltd will ensure that impacts are minimised to an acceptable level. This can be managed through the implementation of an Environmental Management Plan. However, should this route not become available Alternative 1A and 1B of Option 2 are also acceptable.

9.2. Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. 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 of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The viability of establishing a wind energy facility on a site near Copperton has been established by Garob Wind Farm (Pty) Ltd. The positive implications of establishing a wind energy facility on the identified site include:

» The injection of electricity into the grid, at the proposed point, would serve to strengthen the power supply in the area.
» Wind energy facilities have an advantage over other more conventional power generating facilities (e.g. coal-fired power stations). The facilities utilise a renewable source of energy (considered as an international priority) to generate

power and is therefore generally perceived in a positive light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks.

» The project is anticipated to have positive social and health related impacts through the "greener" technology that will be used (limited noise, no emissions etc).
» On a global scale the project has the potential to assist in reducing carbon dioxide emissions which would thus have an ameliorating impact on global climate change.
» The project will have numerous benefits during both the construction and the operation phase by way of employment opportunities, skills development, and capacity building within the local communities.

The key documents that provide guidance regarding planning in the area include the:

» Siyathemba Local Municipality Integrated Development Plan (IDP) (2010-2011).
» Pixley ka Seme District Municipality Integrated Development Plan (IDP) (2010 – 2011)
» Northern Cape Provincial Growth and Development Strategy (2004-2014).

The promotion of renewable energy development is supported by this planning documentation.

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 construction and operation of the proposed **Garob Wind Farm** conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. No absolute no-go areas were identified on the proposed development site, although some areas of potential sensitivity where additional mitigation would be required have been highlighted. The significance levels of the majority of identified negative impacts can generally be reduced to impacts of medium to low significance by implementing the recommended mitigation measures. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within **Appendix O**.

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**.**

9.3. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, 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 developmental impacts of the proposed Garob Wind Farm can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for approval of the proposed project by the DEA.

In order to ensure that impacts are mitigated to acceptable levels as detailed in this report, the following conditions would be required to be included within the environmental authorisation issued for the project:

» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices F to N should be implemented to limit the negative impacts and enhance the positives.
» 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 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 key in achieving the appropriate environmental management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.
» The preferred power line alternative for implementation is Option 1. However, should the option become unavailable Alternative 1A and 1B of Option 2 are also acceptable.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.
» Use existing infrastructure where possible to minimise potential ecological impacts from disturbance of vegetation.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» As far as possible, access roads and cable trenches which could potentially impact on sensitive areas should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.

- Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
- Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
- Where drainage lines are required to be crossed by access roads, the relevant permits (or water use licences) must be applied for from the DWA.
- Ensure that power line towers are constructed at least 32 m from the drainage lines (i.e. span the watercourses).
- A comprehensive stormwater management plan should be compiled and implemented for the developmental footprint prior to construction.
- Implement appropriate erosion control measures, specifically in potentially sensitive areas identified within the EIA Report.
- Alien invasive plants should be controlled on site during construction, operation and decommissioning of the proposed facility and associated infrastructure.
- A detailed geotechnical investigation should be undertaken before the engineering design phase to provide more detail. Specialist geotechnical input is recommended during the construction of foundations.
- A walk-though survey of final infrastructure positions for the wind energy facility and associated infrastructure (including the power line) should be undertaken by a specialist ecologist and heritage specialist prior to the commencement of construction. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
- The results of the current pre-construction bird and bat monitoring should inform the need to implement additional mitigation measures, as well as the need to continue with post-construction monitoring.
- The management plan primarily focuses on the mitigation and management of potential secondary visual impacts, because the primary visual impact has very low mitigation potential. In this regard proper planning should be undertaken regarding the placement of lighting structures.
- Applications for all other relevant and required permits required to be obtained by Garob Wind Farm (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any drainage lines (should they be required).

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