ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED MAINSTREAM SPRINGFONTEIN WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE SOUTH-WEST OF SPRINGFONTEIN FREE STATE PROVINCE

DEA Ref. No: 14/12/16/3/3/2/365

DRAFT FOR PUBLIC REVIEW
NOVEMBER 2012

Prepared for:

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PROJECT DETAILS

DEAT Reference No.	:	14/12/16/3/3/2/365
Title	:	Draft Environmental Impact Assessment Report: Proposed Mainstream Springfontein Wind Energy Facility and Associated Infrastructure on a site south-west of Springfontein, Free State Province
Authors	:	Savannah Environmental (Pty) Ltd Ravisha Ajodhapersadh Karen Jodas Gabrielle Wood
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Client	:	South Africa Mainstream Renewable Power Springfontein (Pty) Ltd
Report Status	:	Draft Environmental Impact Assessment Report for public review
Review Period	:	14 November 2012 – 14 December 2012

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INVITATION TO COMMENT ON THE DRAFT EIA REPORT

The draft Environmental Impact Assessment Report is available for review and comment by Interested and Affected Parties (I&APs) and stakeholders at the Springfontein Public Library from 14 November 2012 – 14 December 2012. The report has also made available electronically on www.savannahSA.com/projects. Comments can be made as written submission via fax, post or e-mail.

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 Scoping Report is **14 December 2012**

PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA report and provide feedback on the findings of the studies undertaken, a public feedback meeting will be as follows:

» **Date:** Tuesday 27 November 2012
» **Time:** 17:00
» **Venue:** Springfontein Community Hall, Springfontein

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

South Africa Mainstream Renewable Power Springfontein (Pty) Ltd (herein referred to as "Mainstream") is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Kopanong Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) is within the Free State Province, and lies approximately 12 km south west of Springfontein. Up to 74 wind turbines are proposed to be constructed over a broader area of approximately 83 km^2 in extent. The proposed facility would be known as the Springfontein Wind Energy Facility.

The site for the proposed Springfontein Wind Energy Facility falls within the Kopanong Local Municipality in the Free State. The site was confirmed by Mainstream as being suitable for wind energy development. The broader area (~83 km^2 in extent) is includes the following farm portions (refer to Figure 1.1): Remaining Extent of the farm Stock Port 283; farm Bankfontein 519; farm Mistkuil 412; farm Ou Spioenkop 467, and Remaining Extent of the farm Spioenkop 461.

The project will include the following infrastructure:

- The site is proposed to accommodate up to 74 wind turbines. The facility would be operated as a single facility with each turbine being between 1.4 MW and 4 MW in capacity.
- Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 2m), a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades.
- Internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
- Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
- An on-site substation (100 m x 100 m) to facilitate grid connection.
- A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:
  - **Preferred Grid Connection Option**

    The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop out 132 kV

power line of up to 500m in length, is proposed.

- **Alternative Grid Connection Option:** The alternative grid connection option includes building a new 132 kV substation on farm Stock Port RE/283 as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockpoort. The length of this new power line would be ~4200m. The proposed substation will have a high-voltage (HV) yard footprint of approximately 100m X 100m.

» Up to 2 permanent wind measuring mast(s) of 70 m – 120 m (height), lattice structure
» The main construction site compound for all contractors would be approximately 5000 m^2 in extent.

Mainstream have appointed Savannah Environmental as an independent environmental assessment practitioner to undertake the EIA. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

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

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The

EIA Phase addressed those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) 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 sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report has incorporated all issues and responses raised during the public review of the draft EIA Report prior to submission to the National Department of Environmental Affairs (DEA).

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 Springfontein Wind Energy Facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The 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.

The environmental impacts associated with the proposed project, as identified through the EIA for the proposed project are summarise in Table 1.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation,

monitoring and management measures are implemented.

» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

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

» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.

» The draft Environmental Management Programme (EMP) as contained within Appendix O of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

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

» A comprehensive search for threatened and near-threatened plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure if known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species. In terms of the NEM:BA a permit (A TOPS

permit) is required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Free State Nature Conservation Ordinance.

» The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas (if any) must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMP to be compiled for the project.

» Bird and bat monitoring programmes that are underway on the site should continue in order to inform the final micro-siting of the wind turbines. Pre-construction bird and bat monitoring should continue to establish an adequate baseline for comparative purposes, in line with the last version of the bird and bat monitoring guidelines.

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

» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.

» Establish an on-going monitoring programme to detect, quantify and remove any alien plant species that may become established.

» Adequate stormwater management measures to be put in place as the soils on the site are highly prone to erosion due to shallow profiles and steep slopes.

» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).

» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.

» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.

» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMP).

» Applications for all other relevant and required permits if required to be obtained by Mainstream must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licence for abstraction of water from borehole/s,

disturbance of protected vegetation, and disturbance to any water courses/ drainage lines.

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

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Loss or fragmentation of vegetation & protected plant species	Medium	Low
Impacts on Watercourses / Drainage Lines	Medium	Low
Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.	Medium	Low
Impact on threatened animals species / habitat	Low	Low
Alien vegetation growth due to disturbance	Medium	Low
Loss of habitat within indigenous natural vegetation types, disturbance and soil erosion due to creation of permanent access roads.	Medium	Low
Impacts on Avifauna		
Bird mortalities due to collisions with wind turbines	High	Medium
Impact on birds due to disturbance of habitat	Medium	Low
Loss of avifauna habitat	Medium	Low
Electrocution/ collision of birds with the power line	Medium	Low
Impacts on Bats		
Disturbance and/or destruction of bat roosts due to construction activities	Medium	Low
Bat fatalities due to collision or barotrauma while foraging	High	Medium
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with high agricultural potential and land capability and impact on land-use	Low	Low
Soil Erosion / degradation during construction	High	Low
Soil contamination / soil erosion during the operation of the facility	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase (Positive Impact)	Medium	Medium
Impact of the presence of construction	Low	Low

Nature	Without mitigation	With mitigation
workers in the area on local communities		
Risk of Stock theft and damage to farm infrastructure	Medium	Low
Increased risk of fires during construction	Medium	Low
Increases traffic on roads due to construction	Low	Low
Damage to and loss of farmland during construction	Medium	Low
Benefits associated with the establishment of a community trust	Medium	Low
Operational Phase -Creation of Long- Term employment and business opportunities	Low	Medium
Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa	Medium	Medium
Long-Term Impact of the project on Existing Farming Activities on the Site	Low	Low
Impact of the wind energy facility on tourism in the region	Low	Low
Health Impacts due to the Operation of the wind energy facility	Low	Low
Visual Impacts		
Change in visual character and sense of place	Medium	N/A
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	Low	Low
Shadow Flicker	Low	Low
Noise Impacts		
Noise impacts due to construction activities	Low	Low
Noise impacts from the wind turbines – operational phase	Low	Low
Impacts on Heritage Artefacts		
Impact of construction on archaeology	Medium	Low
Potential Impacts on Palaeontology		
Findings or Loss of Fossils during Construction	Medium	Low

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APPENDICES

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DEA	National Department of Environmental Affairs
DMR	Department of Mineral Resources
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
FS DEDTEA	Free State Department of Economic Development, Tourism and Environmental Affairs
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, 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
NC DENC	Northern Cape Department of Environment and Nature Conservation
NWA	National Water Act (Act No 36 of 1998)
PGWC	Provincial Government of the Western Cape
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment

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.

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Betz Limit: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit.

Calcrete: A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.

Clean Development Mechanism (CDM): An arrangement under the Kyoto Protocol allowing industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The most important factor of a CDM project is that it establishes that it would not have occurred without the additional incentive provided by emission reductions credits. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialised countries. The CDM is supervised by the CDM Executive Board

(CDM EB) and is under the guidance of the Conference of the Parties (COP/MOP) of the United Nations Framework Convention on Climate Change (UNFCCC) (refer http://unfccc.int/kyoto_protocol/mechanisms/items/2998.php).

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.

Early Stone Age: A very early period of human development dating between 300 000 and 2.6 million years ago.

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.

Energy utilisation factor (EUF): The percentage of actual generation compared to the total possible installed generation annually.

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 Programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

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.

Integrated Energy Plan (IEP): A plan commissioned by the DME in response to the requirements of the National Energy Policy, in order to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

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.

Late Stone Age (LSA): In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).

"Micro-siting": An international convention with regards to wind energy facilities. It refers to the process of specifically determining the position of each turbine based on the wind resource and topographical constraints in order to maximise production.

Middle Stone Age (MSA): An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.

Midden: A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.

Miocene: A geological time period (of 23 million - 5 million years ago).

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

National Integrated Resource Plan (NIRP): Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Palaeontological: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

Ramsar Convention on Wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

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

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened

Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

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

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

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

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

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

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

Wise Use (*sensu* Convention on Wetlands): Defined in Handbook 1 (citing the third meeting of the Conference of Contracting Parties (Regina, Canada, 27 May to 5 June 1987) as "the wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

INTRODUCTION CHAPTER 1

South Africa Mainstream Renewable Power Springfontein (Pty) Ltd (herein referred to as "Mainstream") is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Kopanong Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) is within the Free State Province, and lies approximately 12 km south west of Springfontein. Up to 74 wind turbines are proposed to be constructed over a broader area of approximately 83 km^2 in extent. The proposed facility would be known as the Springfontein Wind Energy Facility.

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

» **Chapter 1** provides background to the proposed wind energy facility project and the environmental impact assessment
» **Chapter 2** describes the site selection and project alternatives
» **Chapter 3** describes wind energy as a power generation option
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» **Chapter 10** contains a list references for the EIA report and specialist reports.

1.1. Project Description

The site for the proposed Springfontein Wind Energy Facility falls within the Kopanong Local Municipality in the Free State. The site was confirmed by Mainstream as being suitable for wind energy development. The broader area (~83 km^2 in extent) is includes the following farm portions (refer to Figure 1.1): Remaining Extent of the farm Stock Port 283; farm Bankfontein 519; farm Mistkuil 412; farm Ou Spioenkop 467, and Remaining Extent of the farm Spioenkop 461.

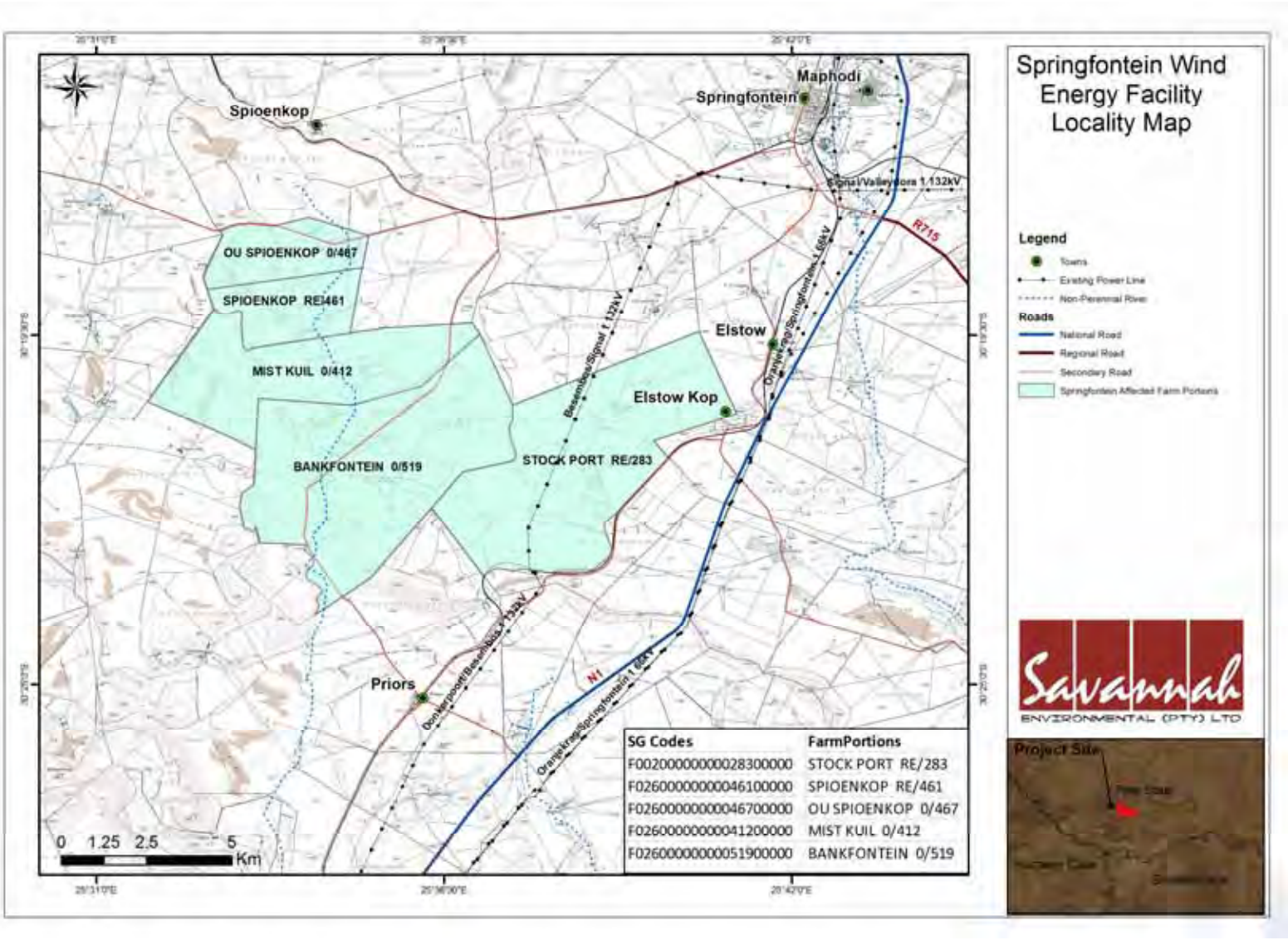

Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Springfontein Wind Energy Facility, Free State Province

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

The capacity of the Springfontein wind energy facility will depend on the most suitable wind turbine (in terms of the turbine capacity) selected by Mainstream. Turbines of between 1.4 MW and 4 MW in capacity are being considered for the site. The developer has not yet identified a specific manufacture and wind turbine model but did indicate that a 1.4 – 4.0 MW wind turbine will be considered. The worst case scenario i.e. a wind turbine up to 4MW in capacity has been considered in the EIA. Up to 74 wind turbines are proposed to be constructed on the site. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 170MW.

Specialist software is available to assist developers in selecting the optimum position for each turbine before the project is constructed. This layout also informed the positioning of other infrastructure such as access roads and substation/s. The preliminary positioning or detailed layout of the components of this wind energy facility has been developed and is shown in **Figure 1.2**. Final placement will be informed by the outcomes of the EIA as well as from the results of the on-site wind monitoring. The site is proposed to accommodate up to 74 wind turbines as well as the associated infrastructure which is required for such a facility including, but not limited to:

- Cabling between the turbines, to be laid underground where practical.
- Internal access roads to each turbine.
- Workshop area / office for control, maintenance and storage.
- An on-site substation to facilitate grid connection.
- The options for grid connection include either:
  - A loop-in and loop out of the existing Besembos-Signal 132kV line which traverses the site (on farm Stock Port RE/283); or
  - A new power line to the future planned Eskom Besembos Substation (which is located off the project development site to the south of the site).
- Wind monitoring masts.

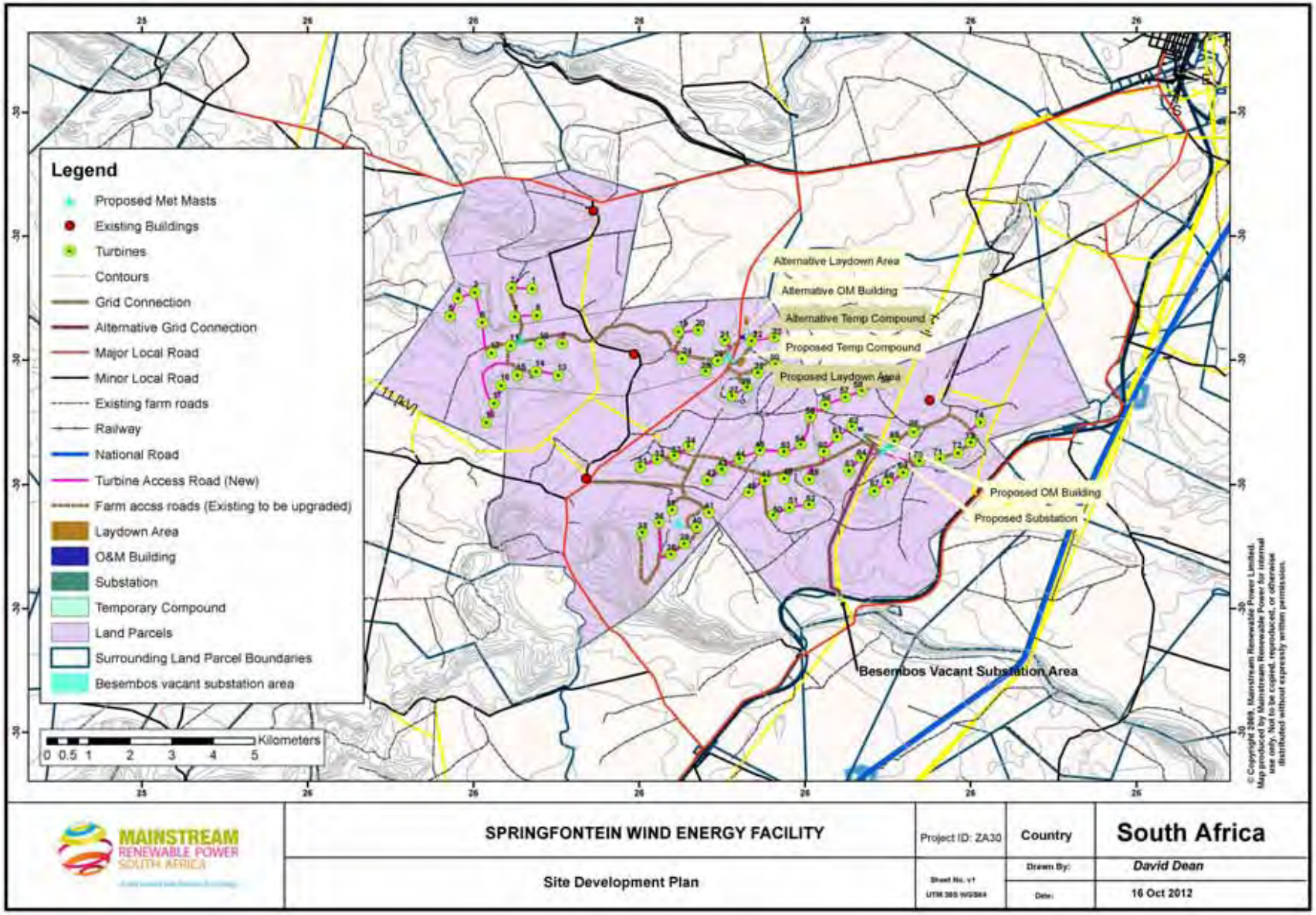

Figure 1.2: Layout map showing the technical design and layout of the Springfontein Wind Energy Facility

1.2. The Need for the Proposed Project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for the area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. Note that the Kopanong Local Municipality does not have a SDF or EMF at this stage. The Kapanong Local Municipality does have an IDP; therefore this policy document is discussed below.

a) Kapanong Local Municipality Integrated Development Plan (IDP) (2010/11)

The most recent IDP for the Kopanong Local Municipality is for the 2010/2011 financial year. The developmental policy contained in the Kopanong Local Municipality IDP is underpinned by the national Strategic Plan for Local Government 2006-20011 , the Free State Provincial Growth and Development Strategy (FSGDS), the national Accelerate and Shared Growth Initiative – South Africa (2006-2014) (ASGISA), and the 2009 National Local Government Turn Around Strategy (re. service delivery challenges and financially sustainable local government).

Of specific relevance to the proposed Springfontein wind energy facility, the IDP notes that in terms of its Key Priority Area (KPA) (Improved Basic Service Delivery and Infrastructure Investment) a key objective is, "*to ensure the provision of adequate and* ***sustainable*** *electricity services to all consumers*" by extending and upgrading the existing network and infrastructure. In addition, as part of its KPA 3 (Local Economic Development) a key objective is, "*To create an environment that is conducive for investors to invest in both urban and rural areas, including the availability of suitable land for a variety of uses, e.g. business, commercial and industrial.*"

While Renewable/Alternative Energy production is not outlined in the KLM IDP 2010/11, the Free State Development Corporation (FDC) has identified the potential for solar energy projects in the larger XDP (including the Kopanong Local Municipality) due to the excellent solar radiation rate in southern Xhariep District Municipality (XDP) (only surpassed by that of Upington) and the availability of land for such developments. In addition, the XDM IDP 2010/11 states that one of its key opportunities is, "*diversifying production of energy from*

renewable sources such as biomass and rivers and solar *to ensure both the price competitiveness of agriculture and help meet South Africa's CO_2 reduction targets.*" While, the IDP makes reference to solar, it is assumed that all forms of renewable energy, including wind, are supported. Therefore the Springfontein wind energy facility is aligned with the Kopanong Local Municipality's IDP.

b) Financial Viability and Community Needs

The developer considered the Springfontein project to be financially viable. The "need and desirability" of the broader community's needs and interests as reflected in a IDP, SDF and EMF for the area, in also considered in the EIA. In South African context, developmental needs (community needs) are often determined through the above planning measures (IDP, SDF and EMF). The Springfontein wind energy facility project is in line with the Kapanong Local Municipality Integrated Development Plan (IDP) (2010/11), as discussed above. The Kopanong Local Municipality is in need of economic development, infrastructure and job creation for the local community. The development of the Springfontein project can positively contribute to these community/ municipal needs in the area.

c) The Need for the Springfontein Wind Energy Facility 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, Mainstream proposes the establishment of the Springfontein Wind Energy Facility to add new capacity to the national electricity grid.

The development of the project would benefit the local/regional/national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation. In addition, according to Department of Energy (DoE) bidding requirements the developer

must plan for a percentage of the profit per annum from the wind energy facility to go back into the community through a social beneficiation scheme. Therefore there is a potential for creation of employment and business opportunities, and the opportunity for skills development of for the local community.

d) The Desirability for the Springfontein Wind Energy Facility Project

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

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical point of view. Mainstream considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development. Wind monitoring is currently being undertaken using a SoDAR device in order to confirm the wind resource on the site, and ultimately inform the layout of the facility well as the turbine selection process.

The current land-use on the site is agriculture (sheep, cattle, and/or game farming (including hunting)). The proposed site and majority of land surrounding it have minimal or no crop farming taking place. The development of the wind energy facility will allow current livestock grazing on areas of the farm portions which will not be occupied by wind turbines an associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. This represents a win-win situation of landowners, the site and the developer.

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

The principles of NEMA have been considered in this assessment through compliance with the requirements of the relevant legislation in undertaking the assessment of potential impacts, as well as through the implementation of the

principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principle of minimisation of pollution and environmental degradation.

This process has been undertaken in a transparent manner and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority.

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

1.3. Technical Motivation for the Project

The proposed Springfontein Wind Energy Facility was identified by Mainstream as a highly desirable site based on a pre-feasibility assessment that was conducted for a larger area within the Free State. The proposed Springfontein Wind Energy Facility site displays characteristics which makes it a preferred site for a Wind Energy Facility such as land availability, connection to the Eskom grid, existing land-use (grazing of livestock, wind resources and a network of farm access roads for ease of access). The proposed farm portions cover an area approximately 83km^2 in extent, which is sufficient for placement of up to 74 the wind turbines. The Besembos-Signal 132kV line distribution power line traverses the site (on Farm Stock Port RE/283) for ease of grid connection, without the need for additional long power lines for connection. In addition, the construction and operation of the wind energy facility would permit the continuation of present farming activities (cattle, sheep and limited game farming) and as such would not result in the loss of agricultural land.

1.4. Potential Environmental Sensitivities Identified during the Scoping Phase

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

» **A non-perennial river and drainage lines that occur within the development site boundaries:**

- There is one non-perennial river that transects the entire site. The non-perennial river has been buffered at 200m and it is recommended that no infrastructure be placed in this drainage line, as avoidance of impacts is preferred. Should avoidance of impacts on the non-perennial river not be possible, then consultation with the Department of Water Affairs must be undertaken to determine the need for a water use permit.
- There are a number of non-perennial drainage lines that occur on the site. These are considered to be of high sensitivity. According to the National Water Act a watercourse'' means -

  (a) a river or spring;

  (b) a natural channel in which water flows regularly or intermittently;

  (c) a wetland, lake or dam into which, or from which, water flows; and

(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks. Drainage lines/non-perennial streams provide habitat for a number of plant/animal species in the study area, including those with a restricted distribution or species with an elevated conservation status. Drainage lines (water resources) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. The drainage lines shown in the scoping level sensitivity map have been mapped at a desktop level.

» **Potential habitat for protected flora and fauna:**

A large proportion of the site comprises areas of medium ecological sensitivity, which would be potentially suitable for the development of the wind energy facility. Areas of medium-high ecological sensitivity include the tops of ridges and slopes on account of a potentially higher abundance of listed and protected plant species which correspond with areas of greater faunal sensitivity and erosion sensitivity of the soils. Development within these areas should therefore proceed with caution and additional precautions may be necessary to ensure that impacts on protected and listed plant species are minimised.

» **Potential bird and/bat sensitive habitats:**

On a habitat level, a desktop avifauna sensitivity map includes the following habitat that may support target bird species:

- High sensitivity - Drainage lines and farm dams
- Medium sensitivity – the unnamed non-perennial river that transects the site.

These areas may also correspond with the habitat that could support bats on the site which will have to be further investigated by the bat study. .

» **Noise sensitive receptors**

The construction and operation of the wind energy facility will have potential impacts on noise sensitive receptors within the proposed development. A buffer around these receptors will be recommended during the EIA phase based on site conditions (to be verified in the EIA phase), as avoidance of noise impacts is an achievable target if wind turbines are micro-sited correctly.

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

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

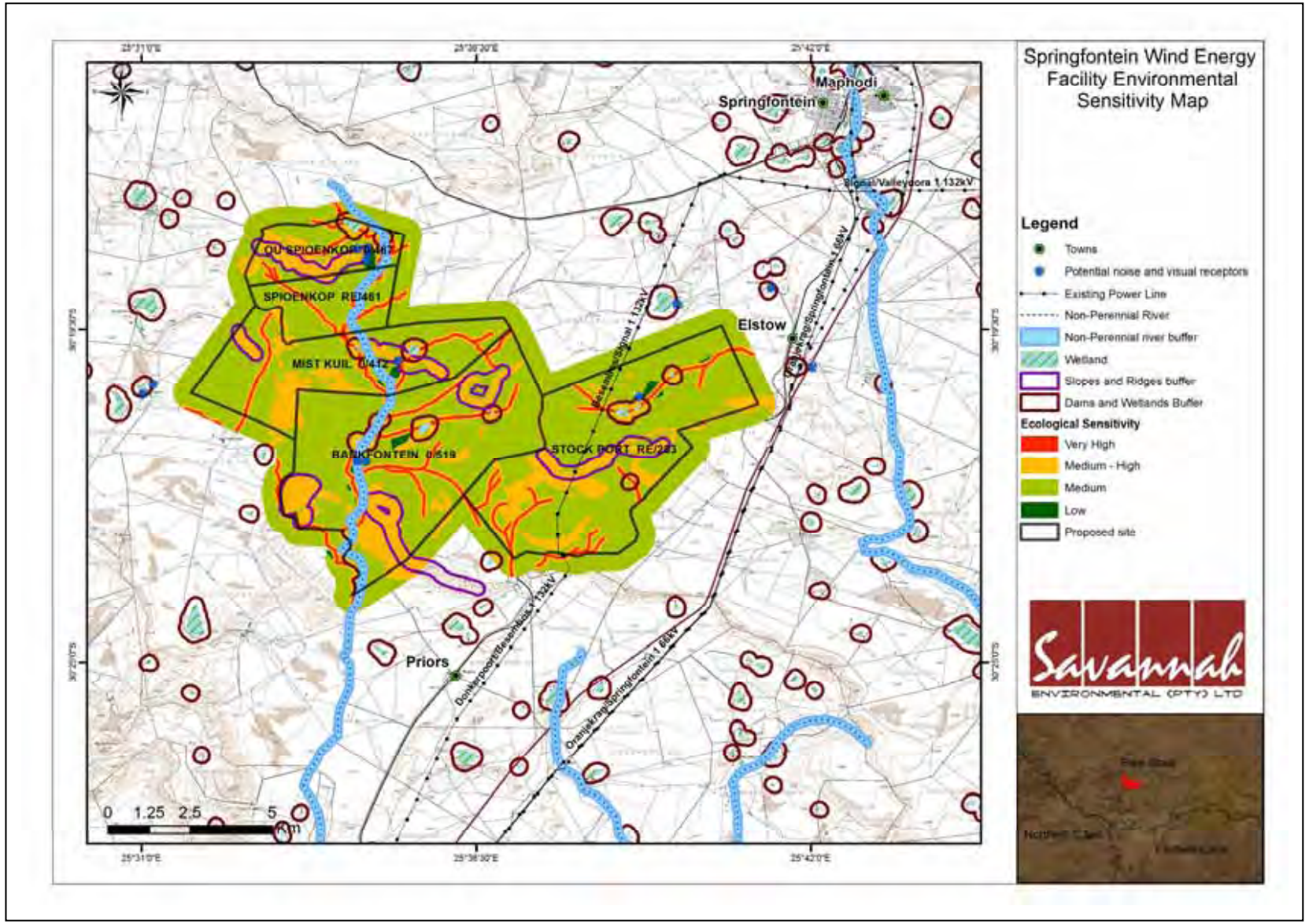

Figure 1.3: Scoping study desktop environmental sensitivity map for the proposed Springfontein Wind Energy Facility

1.5. Requirement for an Environmental Impact Assessment Process

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

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by the DEA (under Application Reference number: 14/12/16/3/3/2/365). Through the decision-making process, the DEA will be supported by the Free State Department of Economic Development, Tourism and Environmental Affairs (FS DEDTEA), as the commenting authority.

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

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

In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the

proposed project (GG No 33306 of 18 June 2010). The application for authorisation has been made for the following listed activities:

Indicate the number and date of the relevant notice:	**Activity No (s) (in terms of the relevant notice) :**	**Describe each listed activity as per project description[1]:**
GN544	10	***The project includes the construction of high voltage power line/s (outside an urban area)*** – The construction of facilities or infrastructure for the transmission and distribution of electricity – (a) Outside urban areas or industrial complexes with a capacity of more than 33kv but less than 275kv; or (b) Inside urban areas or industrial complexes with a capacity of 275kv or more.
GN545	15	***The total development footprint will cover an area greater than 20 ha*** in extent. 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; Except where such physical alteration takes place for: *(i)* Linear development activities. *(ii)* Agriculture or afforestation where activity 16 in this schedule will apply.
GN545	1	***The wind energy facility will consist of wind turbines for electricity generation of up to 170MW.*** The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more..
GN544	13	***The wind energy facility will require facilities for storage of fuels / oils that are up to 500m^3.). -*** 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;

[1] Please note that this description should not be a verbatim repetition of the listed activity as contained in the relevant Government Notice, but should be a brief description of activities to be undertaken as per the project description

GN544	11	The wind energy facility will include the construction of infrastructure (such as access roads) within 32m of a watercourse).The construction of: (i) canals; (ii)channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk stormwater outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size (ix) slipways exceeding 50 square metres in size (x) buildings exceeding 50 square metres in size; or (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 from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
GN544	47	**The wind energy facility will require construction haul roads up to 10m wide and more than 1k m in length \ which will occur in rural/ farming areas.** 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 – excluding widening or lengthening occurring inside urban areas.
GN544	22	**e The wind energy facility will require construction haul roads up to 10m wide to be constructed in rural/ farming areas.** The construction of a road, outside urban areas, (i) with a reserve wider than 13.5 metres or, (ii) where no road reserve exists where the road is wider than 8 metres, or (iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 of Government Notice 387 of 2006 or activity 18 of Notice 545 of 2010.

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

1.6. Objectives of the Environmental Impact Assessment Process

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

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

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

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

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

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

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

The 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 15 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.
» Ravisha Ajodhapersadh– the principle author of this report holds an Honours Bachelor of Science degree in Environmental Management and has 5 years experience in environmental management and EIA. She is currently the responsible EAP for several renewable energy projects across the country.

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

Specialist	Area of Expertise
Simon Todd of Simon Todd Consulting	Ecology (including flora and fauna)
Andrew Pearson and Megan Diamond of the Endangered Wildlife Trust (EWT)	Avifauna
Claire Patterson-Abrolat and Kath Potgieter of the Endangered Wildlife Trust (EWT)	Bats
Reuben Heydenrych and team of Aurecon	Visual impact
Stephan Gaigher of GA Heritage Management Consultants	Heritage and Palaeontology
Tony Barbour Environmental Consulting and Research	Socia
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

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

SITE SELECTION AND ALTERNATIVES CHAPTER 2

The site identified for consideration of the Springfontein wind energy facility within an Environmental Impact Assessment (EIA) is within the Kopanong Local Municipality, Free State Province, and lies approximately 12 km south west of Springfontein. Up to 74 wind turbines are proposed to be constructed over an area of approximately 83 km^2 in extent. Associated infrastructure proposed includes a substation, access roads, office and a power line.

The technical design and layout of the wind energy facility is illustrated in Figure 2.1. **Appendix P** contains A3 maps showing the detail of the layout of the facility. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is –up to 170MW and will comprise of the following infrastructure:

- The site is proposed to accommodate up to 74 wind turbines.
- Cabling between the turbines, to be laid underground where practical.
- Internal access roads to each turbine.
- Workshop area / office for control, maintenance and storage.
- An on-site substation to facilitate grid connection.
- The options for grid connection include either:
  - A loop-in and loop out of the existing Besembos-Signal 132kV line which traverses the site (on farm Stock Port RE/283); or
  - A new power line to the future planned Eskom Besembos Substation (which is located off the project development site to the south of the site).
- Two wind monitoring masts.

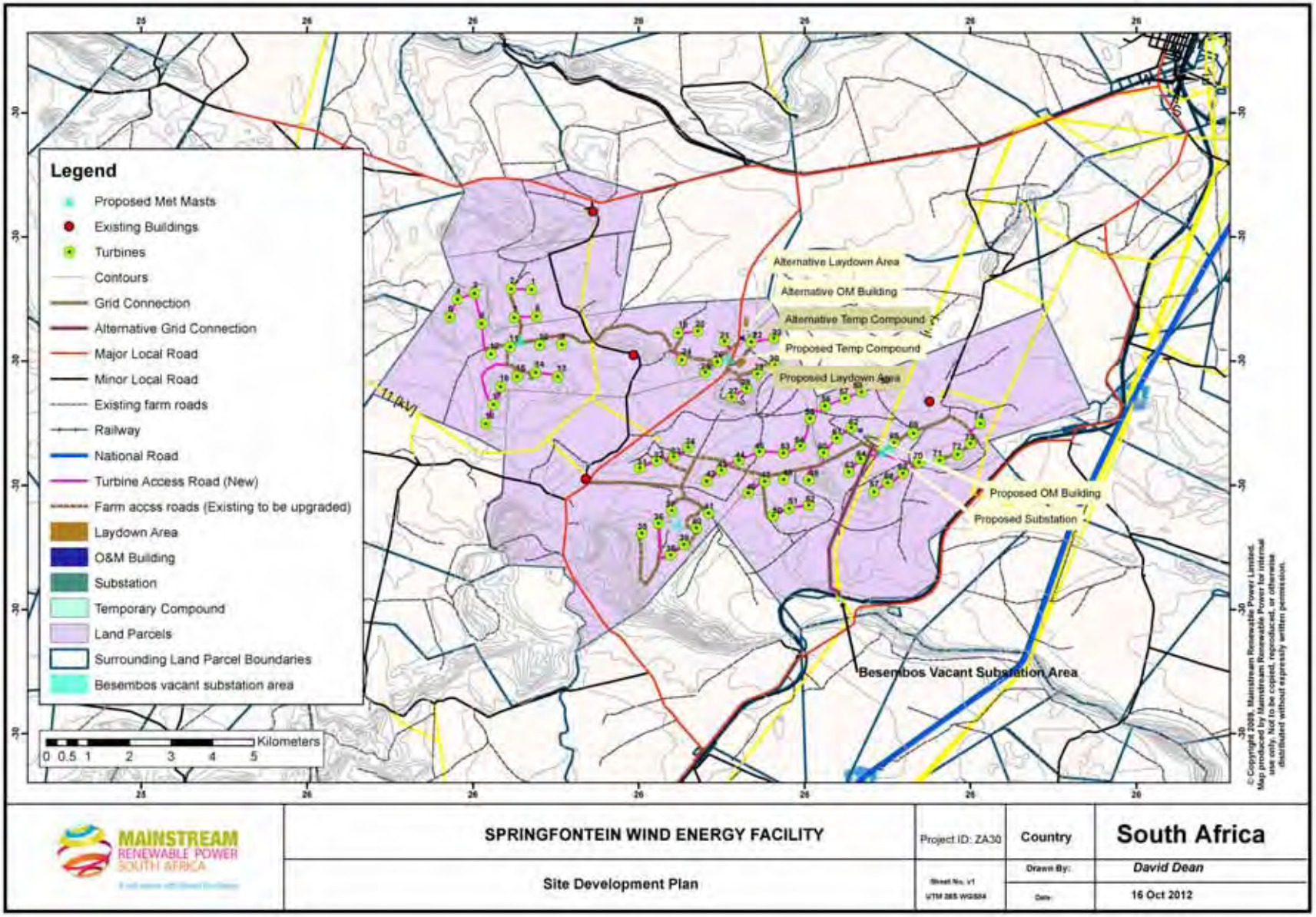

Figure 2.1: Layout map showing the technical design and layout of the Springfontein Wind Energy Facility

2.1. Site Selection and Pre-Feasibility Analysis

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

2.2 Technology Alternatives

Based on site characteristics it was determined by Mainstream that the site would only be suitable for a wind energy facility, and is not suitable for the installation of other renewable energy technologies. Through the project development process, Mainstream will be considering various wind turbine designs in order to maximise the capacity of the site. It is anticipated that the turbines utilised for the proposed Springfontein Wind Energy Facility in the Free State will have a hub height of up to 120 m, and rotor diameter of 120 m (i.e. turbines between 1.4 MW – 4M is being considered for use on the site). The technology provider has not yet been confirmed, and will only be decided after further wind analysis as well as a tender process.

2.3 Site-specific or Layout Design Alternatives

A wind turbine layout has been undertaken to effectively 'design' the wind energy facility. Through the process of determining constraining factors and environmentally sensitive areas during the scoping phase, the layout of the wind turbines and infrastructure has been developed by Mainstream (the layout is shown in **Figure 2.1**.) This layout is considered to be an 80% accurate layout, and 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 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/s.

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 (substation and power line routes)
» Two options for the location of the operations and maintenance building.
» Two options for the location of the construction laydown area.
» Two options for the location of the temporary construction compound.

These layout alternatives are shown in **Figure 2.1**, are described below, and assessed in Chapter 7.

2.3.1 Two options for grid connection (substation and power line routes)

The options for grid connection are as follows:

» **Preferred Grid Connection Option**
The preferred grid connection option includes the construction of a new 132kV substation directly adjacent to the existing Besembos-Signal 132kV power line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV power line, a loop-in and loop-out configuration is proposed, with a 132 kV power line of up to 500m in length.

» **Alternative Grid Connection Option:**
The alternative grid connection option includes the construction of a new 132kV substation on farm Stock Port RE/283, as well as a new power line to the future planned Eskom Besembos Substation (which is located at the southern boundary of Farm Stockpoort). The length of this new power line would be ~4200m.

2.3.2 Two options for the location of the operations and maintenance (O&M) building

The operations and maintenance (O&M) building will be used during the operational life of the wind energy facility. This building will include a yard of ~1 hectare in size. The actual building will be 20m x 20m. The locations selected for the buildings were based on the space required for the building and ease of access.

» **Preferred location for the O&M Building**
The preferred location for the permanent O&M building is on the Remaining Extent of Farm Stock Port, adjacent to the preferred substation site.

» **Alternative location for the O&M building**
The alternative location for the O&M building is proposed on the northern edge of Farm Bankfontein 519, just off the gravel road which traverses the Farm.

2.3.3 Two options for the location of the construction laydown area

The construction laydown area will be temporary area for the contractor's plant and materials. It will be ~1 hectare in size. Both preferred and alternative options are located on Farm Bankfontein 519, ~120 m off the gravel road which traverses the Farm.

2.3.4 Two options for the location of the temporary construction compound

A temporary construction compound will be required during the construction phases to provide amenities and housing for up to 10 construction workers such as security guards. The construction compound will be ~5 000 m^2 (or 0.5 hectares) in extent. Both preferred and alternative options are located on Farm Bankfontein 519, just off the gravel road which traverses the Farm.

2.4 The 'do-nothing' Alternative

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

The primary considerations pertaining to the do-nothing alternative relate to:
1. The current land-use regime of the site; and
2. The need to diversify the energy mix is South Africa.

These are discussed in further detail below.

1. The agricultural potential of the site is low to moderate potential and limited to extensive grazing due to the low rainfall in the area. The climate of the area is categorised as arid. The mean annual rainfall of the area where the site is located is approximately 250mm. This region is non-arable. The "best use'' for the area is for grazing with livestock. The grazing capacity of the region varies between 18 ha/LSU and 21 ha/LSU (Department of Agriculture & Fisheries, 1981). The "do nothing" alternative would leave current land-use

and livestock grazing, with losing out the opportunity to generate renewable energy from the wind and at the same time continue current livestock grazing on areas that outside of the proposed wind energy facility infrastructure. The current land-use on the site is agriculture (sheep, cattle, and/or game farming (including hunting)). The proposed site and majority of land surrounding it have minimal or no crop farming taking place. The development of the wind energy facility will allow current livestock grazing on areas of the farm portions which will not be occupied by wind turbines an associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. This represents a win-win situation of landowners, the site and the developer. Therefore, from a land-use perspective, the do nothing alternative is not preferred.

2. The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. There is, therefore, a need for additional electricity generation options to be developed throughout the country. The decision to expand South Africa's electricity generation capacity, and the mix of generation technologies is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom Holdings Limited (as the primary electricity supplier in South Africa). The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are taken into account.

   The generation of electricity from renewable energy in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in further by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, where compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South

Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.

» **Exploitation of our significant renewable energy resource:** At present, valuable national resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.
» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.
» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.
» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to final energy consumption by 2013. Furthermore the IRP 2010 states that 42% share of all new power generation should be derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010 – 2030). The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DME's macroeconomic study on renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. In addition, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh (NERSA, March 2009).

Through research, the viability of the Springfontein Wind Energy Facility has been established, and the developer proposes that up to 74 turbines (depending on the turbine selected) can be established as part of the facility. The 'do nothing' alternative will not assist the South African government in reaching the set targets for renewable energy. In addition the Free State's power supply will not be strengthened by the additional generated power being evacuated directly into the Provinces' electricity grid.

The 'do nothing' alternative is not a preferred alternative, as the result of not developing the wind energy facility will be that the following positive impacts will not be realised:

» Job creation from the construction and operational phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Community benefit (Socio and local economic development)
» Utilisation of clean, renewable energy in an area where it is optimally available.

WIND ENERGY AS A POWER GENERATION OPTION CHAPTER 3

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

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The power generated from the Springfontein wind energy facility will be up to 170MW, at a commercial scale to feed into the Eskom grid.

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

3.1 The Importance of the Wind Resource for Energy Generation

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

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

determines the cost of generating electricity. The doubling of wind speed increases the wind power by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating at wind speeds of between ~3 m/s to 4 m/s, with wind 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 8 times the rotor diameter apart in order to minimise the induced wake effect the turbines might have on each other. Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria) the spacing requirements 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 via a gearbox and drive train.

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed Springfontein Wind Energy Facility in the Free State will have a hub height of up to 120 m, and rotor diameter of 120 m. These turbines would be capable of generating in the order of up to 4 MW each (in optimal wind conditions).

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components:

» 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 or concrete. It is typically up to 120m tall. The nacelle and the rotor are attached to the top of the tower.

The tower is part of the overall wind turbine structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

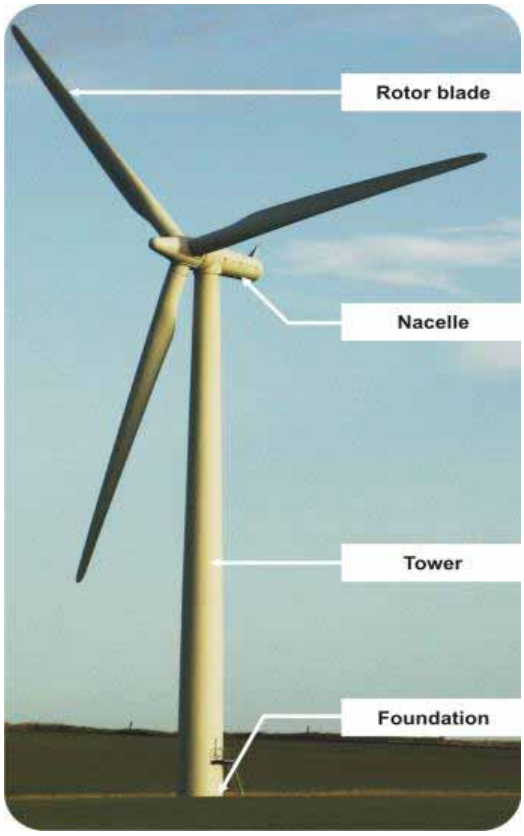

Figure 3.1: Illustration of the main components of a wind turbine

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.

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.

REGULATORY AND LEGAL CONTEXT CHAPTER 4

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

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

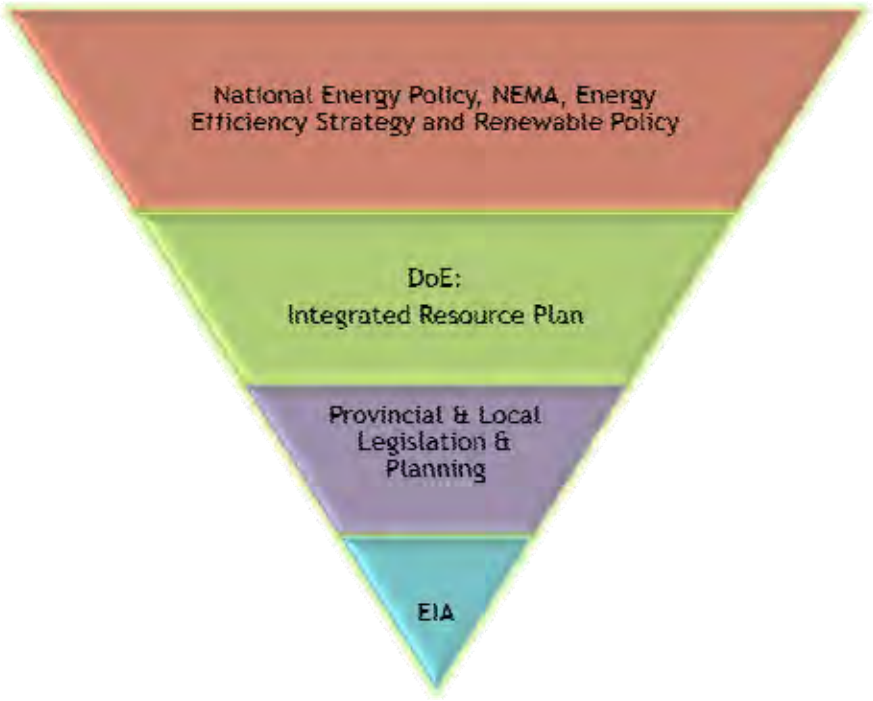

Figure 4.1: Hierarchy of electricity policy and planning documents

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

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

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

4.1.2 Renewable Energy Policy in South Africa, 1998

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

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

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

4.1.3 Final Integrated Resource Plan, 2010 - 2030

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

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

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

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

4.1.4 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent

Power Producers (IPPs). NERSA has recently published a request for qualification and proposals for new generation capacity under the IPP procurement programme, and is in the process of updating and developing its process in relation to the awarding of electricity generation licences.

4.2. Regulatory Hierarchy for Energy Generation Projects

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

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

» *Department of Energy (DOE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). Wind energy is considered under the White Paper for Renewable Energy (2003) and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations 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 Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies

governing the Agriculture, Forestry and Fisheries Sector. This Department has published a guideline for the development of wind farms on agricultural land.

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

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

» *Free State Department of Economic Development, Tourism and Environmental Affairs (FS DEDTEA):* This Department is the commenting authority for this project.
» *Department of Police, Roads and Transport (Free State):* This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Free State Heritage Resources Agency:* This body is responsible for all heritage related issues in the Free State 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.
» Free State Department Of Cooperative Governance And Traditional Affairs Directorate Spatial Planning Specialized Town And Regional Planning Unit: Permit required in terms of the Physical Planning Act.

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

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.

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

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

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

The following legislation and guidelines have informed the scope and content of this Draft 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)
» Kopanong 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 addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table in Table 4.1.

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

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

	duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
National Environmental Management: Waste Act (Act No 59 of 2008)	» The purpose of this Act is to reform the law regulating waste management in order to protect health and the environment by providing for the licensing and control of waste management activities. » The Act provides listed activities requiring a waste license.	Hazardous Waste – National DEA General Waste – FS DEDTEA	Waste licence could be required in the event that more than 100m^3 of general waste or more than 35m^2 of hazardous waste is to be stored on site at any one time. The volumes of waste generated during construction and operation of the facility are not expected to be large enough to require a waste license.
Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns	National Department of Environmental Affairs Provincial Environmental Department - commenting authority. Local authorities Local Municipality	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix K). There are noise level limits which must be adhered to.

National Water Act (Act No 36 of 1998)	Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999. In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs	A water use permits or licenses are required to be applied for or obtained, if infrastructure such as access roads cross drainage lines. Abstraction of groundwater from boreholes will also require a water use licence,.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in Section 39 of the Act.	Department of Mineral Resources	If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 34 makes provision for: (1) the Minister to prescribe essential national noise standards - (a) for the control of noise, either in general or by specified machinery or activities or in specified places	National Department of Environmental Affairs – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission licence issued in terms of Section 22 may contain conditions in respect of noise.

	or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.		This will however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. Heritage Western Cape	Section 4 of the NHRA provides that within 14 days of receipt of notification the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe a heritage resource may be affected. A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

	development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened & protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and	National Department of Environmental Affairs	Specialist flora and fauna studies are required to be undertaken as part of the EIA process. A specialist flora, fauna and wetland's assessment has been undertaken for the proposed project (refer to Appendix F). A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.

	summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011). » This Act also regulates alien and invader species. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. The developer has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems.		
Conservation of Agricultural Resources Act (Act No 43 of	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and	Department of Agriculture	While no permitting or licensing requirements arise from this

1983)	these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.		legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land. In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency.

	inflammable material. In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.		
National Forests Act (Act No 84 of 1998)	Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.	Department of Water Affairs	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. Note that the site does not comprise of any protected tree species.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and	Civil Aviation Authority (CAA)	This act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33. An obstacle approval for the wind energy facility is required to be obtained from the CAA.

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

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

	Regulations.		
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act may find application during through the project EIA.
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested & affected parties have right to be heard	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act will find application during through the project EIA.
Subdivision of Agricultural (SALA) Land Act 70 of 1970	» SALA's main objective is to manage the Sub-division of agricultural land to prevent injudicious fragmentation of agricultural land and the creation of uneconomical units and thus manage the use of agricultural land. SALA is thus a primary tool through which the optimal use of agricultural land is determined. » In the case of wind farms a developer will typically want to lease a portion of the land (2-5%) for a period of about 25 years in order to prove to the financing banks that there is security of tenure, thus enabling bank finance. A lease of more than ten years is regarded by the SALA as an effective subdivision, meaning that consent for the lease agreement has to be obtained from the Minister of Agriculture prior to the lease being signed, otherwise the document would be	National DAFF	Consent is required from DAFF.

	void.		
Physical Planning Act, No. 88 of 1967	» To provide for control of the zoning and subdivision of land for industrial purposes; for the reservation of land for use for specific purposes; for the establishment of controlled areas; for restrictions upon the subdivision and use of land in controlled areas; for the compilation and approval of guide plans; and for restrictions upon the use of land for certain purposes unless reserved for use for such purposes; and for other matters incidental thereto.	FS COGTA	A permit will be required for the rezoning of the land-use for the wind energy facility.
Electronic Telecommunications Act 36 of 2005	» Section 29 requires that (1)Any person who constructs, equips or carries on any railway or works for the » supply of light, heat or power by means of electricity, must— (a) conform to the requirements of an electronic communications network service licensee for the prevention of damage to any of its electronic communications network and electronic communications facilities or works by such construction; (b) before commencing the construction of any such railway or works, give 30 days prior written notice to the electronic communications network service licensee of his or her intention to commence the construction	Telkom	Mo permit requirements, just notice must be given on the construction of the wind energy facility.

Provincial Policies / Legislation			
Free State Noise Control Regulations: PN 24 of 1998	» The control of noise in the Free State Province is legislated in the form of Noise Control Regulations promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989.	Free State DEDTEA	In terms of Regulation 4 of the Noise Control Regulations: "No person shall make, produce or cause a disturbing noise (greater than 5 dBA), or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof".
Free State Nature Conservation Ordinance 8 of 1969	» Regulates nature conservation in the Free State	FS DEDTEA	Removal of protected plant species may require a permit. Apart from the listed species, a number of provincially protected species were present on the site including *Aloe broomii, Ammocharis coranica and Euphorbia clavarioides var. clavarioides.* If these species will be removed then a permit will be required to be obtained from FS DEDTEA.
Local Legislation / Policies / Plans			
Kopanong Local Municipality Integrated Development Plan (IDP) 2010/2011	» Provides the overarching strategic framework for the sustainable long-term management of the municipality	Kopanong Local Municipality	» New developments in the municipality to be in line with the IDP.
Standards			
Noise Standards	Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are:	Local Municipality	The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not

	» SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. » SANS 10210:2004. 'Calculating and predicting road traffic noise'. » SANS 10328:2008. 'Methods for environmental noise impact assessments'. » SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes.		necessarily render an activity unlawful per se.
Draft Guidelines for the Evaluation and Review of Applications Pertaining to Wind Farming on Agricultural Land (Sept 2010)	This document provides an outline of the type of agricultural / soil study required for wind farms and for submission to DAFF.	National Department of Agriculture	Requirements for soils and agricultural potential study
The Equator Principles (June 2003)	The Equator principles is benchmark in the financing of projects, which deals with determining, assessing and managing social and environmental risks related to the financing of projects, such as wind energy facilities.	International Finance Corporation and World Bank	A wind energy facility is considered a Category B project (i.e. projects that have limited adverse social and/ environmental impacts)

Environmental, Health, and Safety (EH&S) Guidelines for Wind Energy (2007)	The EH&S Guidelines for wind energy developments are technical reference documents with general and wind energy specific examples of Good International Industry Practice.	International Finance Corporation (IFC) and World Bank	This document was developed to guide the development of wind projects (which intend on applying for WB/IFC funding). Broad recommendations for management of environmental, health and safety impacts of wing energy facilities are provided in this document, which developers who intend on applying for finance must consider.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 5

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

Figure 4.1: The four phases of the EIA process

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

5.1. Phase 1: Scoping Study

The Scoping Study, which was concluded in August 2012 and the Final Scoping Report was accepted by DEA in November 2012 with the acceptance of the Scoping Report by DEA, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Springfontein Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

The draft Scoping Report compiled was made available at public places for I&AP review and comment from 17 July 2012 – 17 August 2012. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the Final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) in August 2012. The Final Scoping Report was accepted by the DEA in November 2012, as the competent authority (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA as stated in the Scoping Report.

5.2. Phase 2: Environmental Impact Assessment

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

The EIA Phase aims to achieve the following:

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

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

5.3. Overview of the EIA Phase

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

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

5.3.1. Authority Consultation

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

» Submission of a Final Scoping Report (August 2012) following a public review period (and consideration of stakeholder comments received).
» Correspondence with DEA and FS DEDTEA in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

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

» Submission of a Final Environmental Impact Assessment (EIA) Report following the public review period.
» Provision of an opportunity for DEA and FS DEDTEA representatives to visit and inspect the proposed site.
» Consultation with Organs of State that may have jurisdiction over the project:
  * Free State DEDTEA
  * Department of Energy
  * Department of Water Affairs
  * Department of Agriculture, Forestry and Fisheries (DAFF)

- Department of Mineral Resources (DMR)
- South African Heritage Resources Agency (SAHRA)
- Provincial Conservation Authorities
- Department of Transport and Public Works and various District Roads Departments
- South African National Roads Agency
- FS Department of Co-operate Governance and Traditional Affairs
- Department of Land Affairs
- Civil Aviation Authority
- Kopanong Local Municipality
- Xhariep District Municipality
- Eskom
- Telkom
- Sentech

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

5.3.2. Public Involvement and Consultation: EIA Phase

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

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

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

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following

opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

» Focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local and regional press: Die Volksblad & Xhariep Independent)
» Written, faxed or e-mail correspondence

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

Scoping Phase	Advertisement of EIA Process – First round of adverts (Die Volksblad)	July 2012
	Focus group meetings and public meeting	July 2012
	Advertisement of Public Meeting & Availability of Scoping report for public review (Die Volksblad & Xhariep Independent)– Second round of adverts	July 2012
	Distribution of Background Information Document (BID) and written notice	July 2012 – August 2012
	Focus group meetings and site visit with FS DEDTEA	July 2012
	Public review period for DSR	17 July 2012 - 17 August 2012
	Public meeting	01 August 2012
	Notification to registered I&APs that the Final Scoping report was available & submitted to DEA	August 2012
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting (Die Volksblad & Xhariep Independent)– – Third round of adverts	November 2012
	Public meeting & stakeholder meeting	

5.3.4. Identification and Recording of Issues and Concerns

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

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

5.3.5. Assessment of Issues Identified through the Scoping Process

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

Specialist	Area of Expertise	Appendix to EIA Report
Simon Todd of Simon Todd Consulting	Ecology	F
Andrew Pearson of Endangered Wildlife Trust	Avifauna	G
Kath Potgieter and Megan Diamond of Endangered Wildlife Trust	Bats	N
Wessel Oosthuysen and Reuben Heydenrych of Aurecon	Visual	I
Stephan Gaigher of GA Heritage Consultants	Heritage and palaeo	J &M
Tony Barbour Environmental Consulting and Research	Social	L
Louis George du Pisani and Theunis Gert Coetzee of Eduplan cc	Soils, erosion and agricultural potential	H
Morne de Jager of M2 Environmental Connections CC	Noise	K

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

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

  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5.
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment;
  - 2 is minor and will not result in an impact on processes;
  - 4 is low and will cause a slight impact on processes;
  - 6 is moderate and will result in processes continuing but in a modified way;
  - 8 is high (processes are altered to the extent that they temporarily cease); and
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  - Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  - Assigned a score of 2 is improbable (some possibility, but low likelihood);
  - Assigned a score of 3 is probable (distinct possibility);
  - Assigned a score of 4 is highly probable (most likely); and
  - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- The **status**, which is described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

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

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

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

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

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

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

5.3.6. Assumptions and Limitations

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

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

» The technical motivation as to the selection of the proposed development site (including details pertaining to the wind resource, etc.) provided by Mainstream is sufficient and defendable.
» Only one site is available for the establishment of the proposed facility and will be considered in the EIA, and no other sites are available to be included as alternative sites in the EIA. This is based on the detailed wind analysis (with specific measurements on site) which has been done to date, as well as on land availability, access to the site, grid connectivity, etc. It is assumed that the pre-feasibility study undertaken by Mainstream will be sufficient to motivate the selection of the site to DEA.
» It is assumed that the development site identified by Mainstream represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure.
» It is assumed that the new Besembos Substation will be built by Eskom.
» The EIA study was conducted based on a preliminary layout of the wind energy facility provided by Mainstream. It is understood that this layout is preliminary at this stage, but it is assumed that the layout is approximately 80% accurate, and subject to change based on the environmental sensitivities/outcomes from this EIA phase.

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

5.3.7. Public Review of Draft EIA Report and Feedback Meeting

This Draft EIA report has been made available for public review from **14 November 2012 – 14 December 2012** at the following locations:

» Springfontein: Kopanong Library
» www.savannahSA.com

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

» Date: 27 November 2012
» Time: 17h00
» Venue: Springfontein Community Hall, Springfontein

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Die Volksblad and the Xhariep Independent newspaper in November 2012 (refer to **Appendix D**).

5.3.8. Final Environmental Impact Assessment (EIA) Report

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

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the Draft EIA Report provides a description of the environment that may be affected by the proposed Springfontein Wind Energy Facility in the Free State Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field work undertaken by specialists and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist EIA reports contained within Appendices F to N.

6.1 Regional Setting and the Study Area

6.3.1 Regional Setting

The site of the proposed Springfontein Wind Energy Facility is located near the town of Springfontein in the southern part of the Free State. The site is located approximately 12km south west of the town of Springfontein. The N1, which connects Gauteng with the Western Cape, passes to the east of the site. Bloemfontein, the capital city of the Free State Province, is located approximately 150 km north of the site. A settlement called Philippolis is located approximately 33 km north west of the site, and Colesberg is approximately 65km south west of the site. The Gariep Dam and Aventura Resort are located approximately 30 km south-east of the site. The site falls within the Kopanong Local Municipality. The establishment of a wind energy facility and associated infrastructure is proposed on the following farm portions:

» the Remaining Extent of the farm Stock Port 283;
» the farm Bankfontein 519;
» the farm Mistkuil 412;
» the farm Ou Spioenkop 467; and
» the Remaining Extent of the farm Spioenkop 461.

A topographical map illustrating the features of the study area is shown in Figure 6.1.

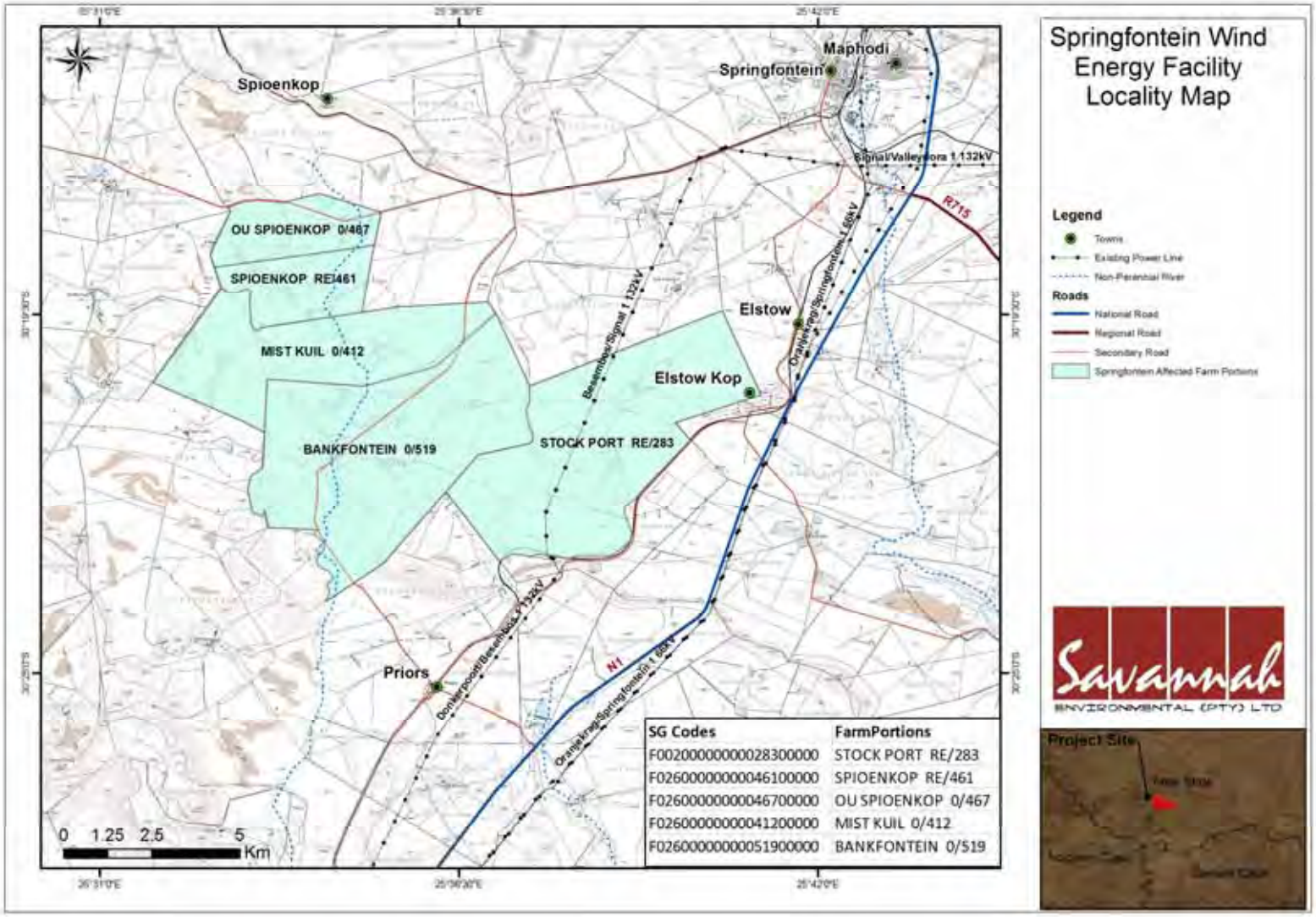

Figure 6.1: Topographical map of the study area

Table 6.1 shows photographs of the site

	
Views of the Site from Farm Ou Spioenkop towards Farm Spioenkop & Farm Mist Kuil	View of the Site from Farm Bankfontein
	
Bontebok game on Farm Bankfontein	Power line on Farm Stock Port 283

6.3.2 Land-Use Character of the Region

All the affected farm portions are currently zoned agricultural land and used for sheep, cattle, and/or game farming (including hunting). The proposed site and majority of land surrounding it have minimal or no crop farming taking place. The small town of Springfontein is the only major settlement in the area with no major services for the surrounding farming communities. There are no large urban or industrial structures in the area and the only major forms of infrastructure are the N1 highway, the railway line and high voltage power lines that are aligned roughly parallel to the N1 (which also transect Farm Stockport 283). There is also telecommunication masts in the broader area.

6.2 Climatic Conditions

The climate of the area is typical of the Northern Steppe and is categorised as a semi-arid region receiving on average about 250mm. The rainfall is largely in the form of showers and thunderstorms falling in the months October to April, the peak of the rainy season being in February to April. The mean annual rainfall of the area is approximately 400mm therefore the site occurs in a semi-arid area where dry land cropping is generally not recommended.

6.3 Biophysical Characteristics of the Study Site and Surrounds

6.4.1 Topography and Geology

The site is situated on the inland plateau, which is characterised by relatively flat terrain. The generally flat topography is interspersed by several scattered outcrops and linear ridges, which are generally, aligned east-west. The geology of the area around Springfontein is composed of alternating layers of mudstone and sandstone, which underlie the flat portions of the landscape, and the harder dolerite sills and dykes underlie the high-lying koppies and ridges. The highest point on the development site is Spioenkop (1740 m above sea level, approximately 13km west of Springfontein and 2.5 km the north of the Ou Spioenkop farm. A satellite view of the site is shown in Figure 6.2.

Figure 6.2: Oblique satellite view of the Mainstream Springfontein Wind Energy Facility project development site showing the topography of the site. The N1 can be seen passing to the east of the site and the outskirts of Springfontein can be seen at the very top of the image.

6.4.2 ***Hydrology, Drainage Lines & Rivers***

Drainage lines and dams, as well as rocky outcrops and steep slopes occur on the site. There is an unnamed and non-perennial stream that transects the site. These features are shown in Figure 6.3. The unnamed watercourse drains through the farms Ou Spioenkop and Spioenkop southwards through Mist Kuil and then Bankfontein, then flows towards the mountainous region in the south of the Bankfontein farm. In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of drainage lines within the site have been assigned a rank of 6, indicating that they do not fall within the any of the priority categories for wetlands and are not good examples (man-made and not pristine) of intact wetlands of biological significance.

Figure 6.3: Landscape and ecological features map of the Mainstream Springfontein Wind Energy Facility study area

6.4.3 ***Soils, Land Use and Agricultural Potential***

a. Land Capability and Agricultural Land-Use

This region is categorised as non-arable with low to moderate potential grazing land, as illustrated in Figure 6.4. The "best use" for the area is for grazing with sheep, goats and beef cattle. The grazing capacity of the region varies between 18 ha/LSU and 21 ha/LSU (Department of Agriculture & Fisheries, 1981). The size of the Relative Homogenous Farming Area which the site is situated in is 177 650ha. The area of the development site (83km^2) represents 3,1% of this area, while the carrying capacity is at best 309 large stock units, resulting in the site being considered to be insignificant in terms of agricultural production and food security on a national scale.

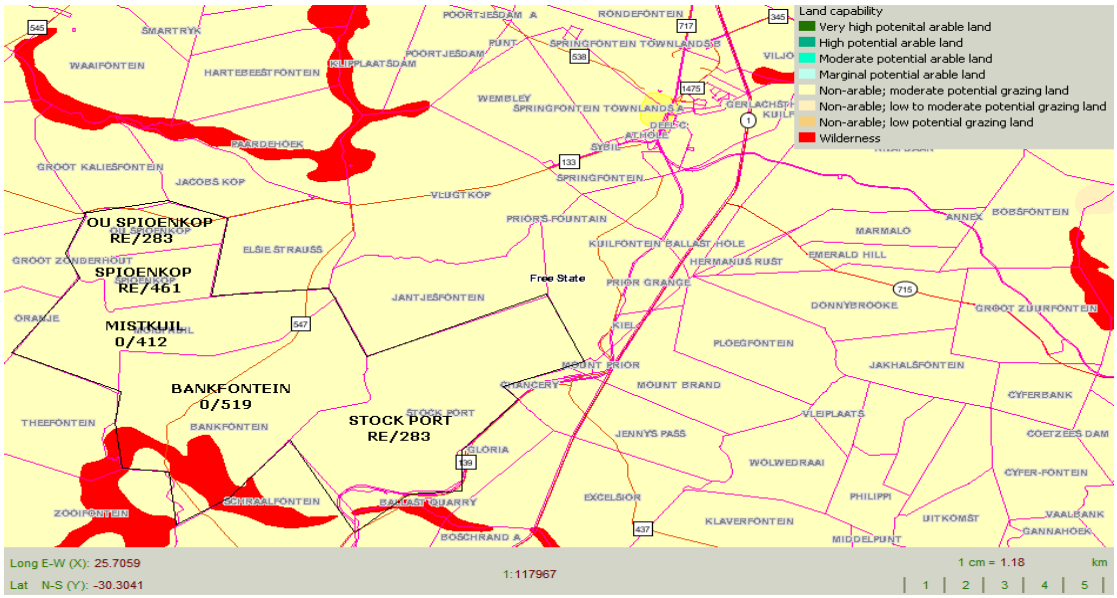

Figure 6.4: Land capability Map (Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za)

b. Land types and Soils

According to the Land Type Survey Staff (1987) and Johnson *et. al*. (2006) the site's geology can be categorised as shale, mudstone and sandstone of the Adelaide Subgroup of the Beaufort Group and Ecca, Karoo Sequence, with rare dolerite intrusions. The site consists of soils with a marked clay accumulation, strongly structured and with a reddish colour.

The site is situated within land types Da50 (85% of the site area), Da41 (5% of the site area), Da34 (5% of the site area) and Ib206 (5% of the site area) (Land Type

Survey Staff, 1987). The landtypes are shown in Figure 6.5. The Da land type consists of soils with either prismacutanic and/or pedocutanic diagnostic horizons, with a red colour in the B-horizon. The Ib land type consists of miscellaneous land classes with rock and miscellaneous soils.

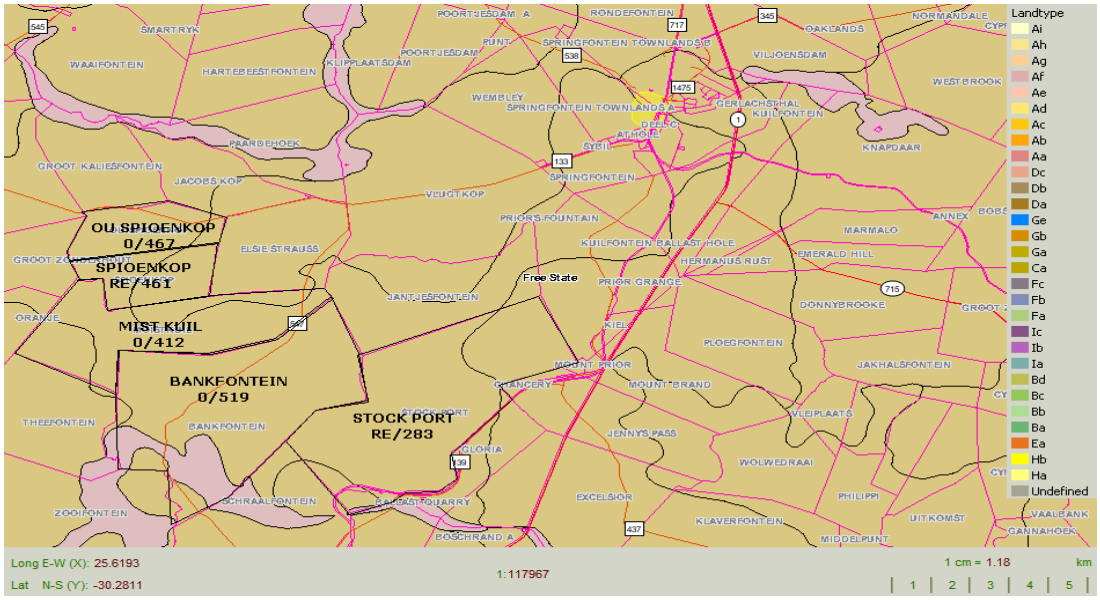

Figure 6.5: Land Type Map (Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za)

The following soil forms occur on the site: Mispah, Glenrosa, Swartland, Valsrivier, Hutton, Sterkspruit, Oakleaf and Shortlands (Land Type Survey Staff, 1987). The soils are generally shallow and the effective depth varies between 50mm and 1200mm (Land Type Survey Staff, 1987). The clay content varies between 6% and 45%. Generally, the soil types and soil depths occurring in the area puts the site in a category of "not suitable for cultivation".

The susceptibility of the soils to wind erosion is categorised as somewhat susceptible (95% of the site area) to susceptible (5% of the site area), the susceptibility to water erosion is low to moderate (on 95% of the site) and moderate to high (on 5% of the site area), and the soil loss potential is moderate (on 95% of the site) and very high (5% of the site area) (AGIS Website of the Department of Agriculture, Fisheries & Forestry – www.agis.agric.za).

There is a small area with high erosion susceptibility on the southern edge of the farm Bankfontein. The slope of the land is generally undulating with approximately 80% of the site having slopes of less than 8%, approximately 5% of the site with slopes between 9% and 12% and 5% of the site with slopes of more than 20%. The southern portion of the farm Bankfontein consists of an area where the slopes

exceed 20%, while the farm Ou Spioenkop has an area where the slopes vary between 13% and 20%.

c. Agricultural Infrastructure

Apart from a few weirs and erosion control dams, there are no important agricultural infrastructure (i.e. silos, irrigation lines, pivot points, channels and feeding structures, etc.) or conservation works (i.e. contour banks, waterways, etc.) that will be interfered with by the development of the wind energy facility.

d. Agricultural infrastructure

There is no important agricultural 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 project development site.

6.4.4 Ecological Profile of the Study Area

a. Critical Biodiversity Areas and Conservation Planning

No fine-scale conservation planning has been conducted for the region, and as a result, no Critical Biodiversity Areas have been defined for the study area. In terms of other broad-scale planning processes, the site does not fall within a National Protected Areas Expansion Strategy Focus Area (NPAES) (refer to Figure 5.6), indicating that the area has not been identified as an area of exceptional biodiversity or of significance for the long-term maintenance of broad-scale ecological processes and climate change buffering within the region.

b. Vegetation

According to the national vegetation map (Mucina and Rutherford 2006), only two vegetation types occur within the study area, i.e. Xhariep Karroid Grassland and Besemkaree Koppies Shrubland. These are described below and are shown in Figure 6.6:

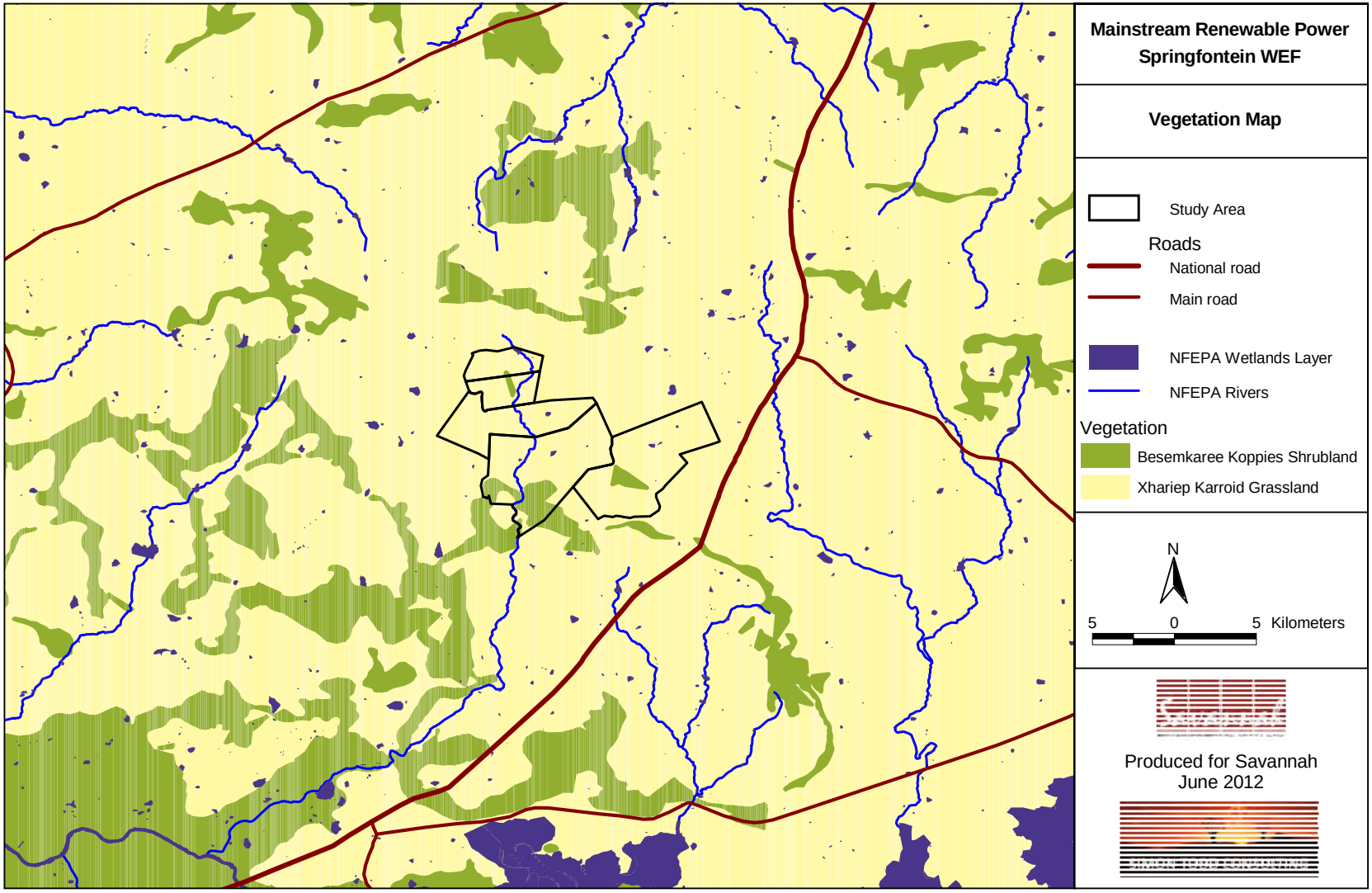

Figure 6.6: The broad-scale vegetation in and around the proposed Mainstream Springfontein Wind Energy Facility

» ***Xhariep Karroid Grassland*** dominates (~90%) the site. Xhariep Karroid Grassland is a relatively widespread vegetation type which occupies 13391 km^2 of the on plains and lower slopes of the southern Free State from the vicinity of Luckoff to Smithfield in an east-west direction and from Edenburg to the Gariep Dam from north to south. Xhariep Karroid Grassland is not a threatened vegetation type and the conservation status of this vegetation type is classified as Least Threatened.

» ***Besemkaree Koppies Shrubland*** occupies ~10% of the site. It occurs on the koppies, butts and rocky slopes which occur within the Xhariep Karroid Grassland and adjacent grassland vegetation types. Besemkaree Koppies Shrubland is not a threatened vegetation type and as a result of its rocky nature has been little impacted by intensive agriculture. Based on the satellite imagery of the site and previous experience in the area, it is likely that the extent of Besemkaree Koppies Shrubland within the site is a lot more extensive than has been mapped by Mucina and Rutherford (2006). This vegetation unit is associated with rocky outcrops which are frequently small or fragmented in nature and many units of this vegetation type are too small to have mapped at a national scale. Based on the analysis of landscape units within the site, there may be as much 1500 ha of this vegetation type.

c. Protected Plant Species of Conservation Concern

Listed species known to occur in the vicinity of the Mainstream Springfontein Wind Energy Facility are listed below in Table 3. Although some of these species may occur at the site, none of these species were observed during the site visit. Apart from the listed species, a number of provincially protected species were present including *Aloe broomii*, *Ammocharis coranica* and *Euphorbia clavarioides* var. *clavarioides*.

Table 6.3. IUCN status of plant species recorded from the vicinity of the proposed Mainstream Springfontein Wind Energy Facility, based on the SANBI SIBIS database.

Family	Species	Status
ASTERACEAE	*Gnaphalium declinatum*	NT
FABACEAE	*Aspalathus intricata subsp. intricata*	Rare
PORTULACACEAE	*Anacampseros subnuda subsp. lubbersii*	VU
LAMIACEAE	*Salvia repens var. keiensis*	DDD
ASTERACEAE	*Senecio glutinarius*	DDT
MESEMBRYANTHEMACEAE	*Nananthus vittatus*	DDT
GERANIACEAE	*Pelargonium sidoides*	Declining

d. Terrestrial Fauna Species

» Mammals:

As many as 51 terrestrial mammals potentially occur at the site. Given the relatively wide range of habitats available which includes, wetlands, plains and rocky hills, a large proportion of species with ranges which overlap the site are likely to be present. Four species of conservation concern potentially occur at the site, these are the White-tailed Mouse *Mystromys albicaudatus* (Endangered), Brown Hyaena *Hyaena brunnea* (Near Threatened), Leopard *Panthera pardus* (Near Threatened), Black-footed Cat *Felis nigripes* (Vulnerable). The Leopard and Brown Hyaena are not likely to occur or be abundant in the area on account of the agricultural land-use in the area which is not usually highly tolerant of large carnivores. The White-tailed Mouse may however occur at the site as the habitat is broadly suitable. The Black-footed Cat is a secretive species which would probably also occur at the site given that it occurs within arid, open country.

» Reptiles

The site lies in or near the distribution range of at least 40 reptile species. This is a comparatively low total suggesting that the site has relatively low reptile species richness. Based on distribution maps and habitat requirements, the composition of the reptile fauna is likely to comprise 1 terrapin, 23 snakes, 14 lizards and skinks and 2 geckos. A single species of conservation concern may occur at the site, the Striped Harlequin Snake *Homoroselaps dorsalis* (Near Threatened). This species inhabits deserted termite mounds where it feeds on worm snakes. As termite mounds are generally common in this part of the Free State, the probability that they would occur at the site is quite high. However, as the distribution of the Striped Harlequin Snake is not highly restricted, the development of the site would not be likely to significantly impact the total population of this species. In general, the rocky outcrops and drainage areas at the site are likely to represent the most important habitats for reptiles.

» Amphibians

The site lies within or near the range of 12 amphibian species, indicating that the site potentially has a moderately diverse frog community. Those that require permanent water are likely to be restricted to the vicinity of the major drainage lines and farm dams. The only species of conservation concern which may occur at the site is the Giant Bullfrog *Pyxicephalus adspersus*. Although it has not been recorded from the quarter degree squares (QDS) which include the site, it has been recorded from several adjacent QDS, suggesting that it potentially occurs at the site. If this species occurs at the site, it would be associated with lowlands, vleis and drainage lines of the site. Given that such environments are protected under the National Water Act (Act 36 of 1998) and are also the lowest position in the landscape they are not favourable for the location of wind turbines and consequently, the development of

the site would not be likely to have a significant direct impact on amphibians and their habitats.

e. Bats

Bats are broadly divided into two groups, insect- and fruit-eating bats. Fruit-eating bats are generally found in the warmer, eastern parts of the country where fruit trees, often of a commercial nature, are commonly found. It is, however, possible that some species may occur at the study site. Insect-eating bats are found across the entire country, including the study site. Therefore, anything that attracts insects is likely to, in turn, attract bats. For example, wetlands, pans, rivers, dumping sites, and animals such as cows and horses are all likely to attract both insects and bats. A total of 17 species are reported to occur in the area, one of which is listed as Vulnerable, two as Near Threatened, 13 as Least Concern, and one as Data Deficient (Monadjem et al., 2010). Of the 17 species reported to occur in the Province[2], one is considered Vulnerable (Percival's Short-eared Trident Bat), three Near Threatened, 12 Least Concern (African Straw-coloured Fruit Bat, Swinny's Horseshoe Bat and the Natal Long-fingered Bat), one Data Deficient (Dent's Horseshoe Bat) according to the IUCN Red List criteria.

The following micro habitats are evident:

» **Drainage Lines & Non-Perennial river:** These are characterised by slow flowing water and tall emergent vegetation, and serve as a feeding site for many bat species.
» **Dams:** Due the standing nature of water in dams, many insects use dams as breeding sites. The presence of these insects often attracts insect-eating bats.
» **Arable or cultivated land:** These areas may represent feeding areas for bat species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, and other food sources suddenly accessible to bats; the crop or pasture plants cultivated attract insects which are in turn eaten by bats. Grazing animals such as cattle or sheep may also attract insects and in turn bats.
» **Thicket:** Many of the bat species listed as possibly occurring on the site are clutter and clutter-edge feeders. The presence of thicket or bush on the site may increase the likelihood of such species being present.

f. Avifauna

Vegetation and micro habitats determine avifaunal abundances and likelihood of occurrences on a site. From an examination of these land uses and vegetation types, it can be expected that species favouring shrublands and grassland type vegetation can be expected, such as Cranes, Korhaans, Larks, Pipits, Prinia and Bustards, as well as

[2] There is limited information available on bat presence and abundance in the Free State Province and for this reason the description has concentrated on bats known to occur in the Province rather than the specific locality.

numerous raptor species. The Blue Crane, Blue Korhaan, Ludwig's Bustard, Greater Flamingo, Secretarybird, Black Stork and White Stork are species with relatively high recorded abundance in the broader study area. These species have all proven vulnerable to collision with other obstacles such as power lines. Bird micro habitats include:

» **Rivers or streams and drainage lines:** Wooded riparian habitat along rivers may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robin-chats and numerous smaller species. Rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Black Storks favor river courses, as do Geese and Ibises. Furthermore any river, stream or drainage line represents an important flight path for many bird species.
» **Arable or cultivated land:** Arable lands appear to exist sparsely in this study area, usually near to wetlands and dams. Relevant bird species that may be attracted to these areas may include Blue Crane, Ludwig's Bustard, Secretarybird, Lesser Kestrel and White Stork. In particular the White Stork has a high affinity with arable lands, with 86% of sightings in South Africa recorded on arable lands (Allan 1985, Allan 1989, Allan 1997 in Hockey, Dean & Ryan 2005), while the Blue Crane will move from roost sites (usually farm dams), to arable lands to feed.
» **Dams:** Various waterfowl, such as Spur-winged geese, South African Shelduck, Egyptian geese, and numerous duck species, may frequent these areas. Blue Cranes use dams to roost in communally, usually flying at dusk from foraging areas back to the dam.
» **Thickets:** These thicket areas are important to physically smaller bird species such as Robin-chats, Scrub-Robins, Warblers, Prinia, Doves and Bulbuls. Clumps of thicket or small thorn trees may provide nesting habitat for the Secretarybird.
» **Hills and Ridges:** There are a number of flat-topped hills in the south of the study area as well as rocky ridges in that run approximately east to west in the south-east, centre and north-west of the study area. Cliffs, Ridges and Hills represent important habitat for a number of species. Most relevant to this study are the aerial species such as raptors and swifts/swallows – which favor flying along ridges where there are favorable air currents. Raptors in particular may be prevalent along pronounced ridges and are likely to hunt along the ridge edge. The tops of these ridges and hills are usually associated with higher winds, which assist in the effortless gliding and soaring of hunting raptors. Raptors such as Verreaux's Eagle may breed on cliffs or rocky ridges on site.
» **Grassy Shrublands:** These are vast open areas of relatively low "shrub-like" vegetation interspersed with grasses. Along with natural grasslands, this is likely to be the predominant micro-habitat on site. "Grassy Shrublands" may be frequented by Karoo Korhaan, Northern Black Korhaan, Blue Crane, Secretary Bird, Kori Bustard and Ludwig's Bustard. Raptors such as Southern Pale Chanting Goshawk, Jackal Buzzard, Martial Eagle, Greater Kestrel, and Black Harrier, may hunt in these areas, while Cape Vulture may forage here. Smaller passerines such as Larks, Pipits, Chats,

Robin-Chats and Prinia also occur. Terrestrial game birds such as Guineafowl and Spurfowl, will also frequent this micro-habitat.

6.4 Social Characteristics of the Study Area and Surrounds

The Free State consists of 4 District Municipalities, namely Xhariep, Thabo Mofutsanyana, Fezile Dabi and Lejweleputswa District Municipalities, and 1 Metropolitan Municipality, the Manguang Metropolitan Area (MMM).

The proposed project is located in the Xhariep District Municipality (XDM), which is located in the south west of the Province and is characterised by a semi-arid area with extensive farming, mainly sheep. The district comprises open grasslands with small widely dispersed towns.

The Mangaung Metropolitan contains three prominent urban centres, namely Bloemfontein, Botshabelo and Thaba Nchu. The Metropolitan accounts for ~ 27% of the Province's population and contributes ~ 33 of GDP in the Free State Province. The main urban centre is Bloemfontein, which is the administrative capital of the Province.

6.4.1 The site

The site itself is used for grazing of livestock and game farming. The homesteads/ residences located on the site and adjacent to the site include:

» Prior Grange Farm (adjacent farm)
» Groot Zonderhout (adjacent farm)
» Farm RE/105 (adjacent farm)
» Farm Oranje (adjacent farm)
» Stock Port Farm (Farm RE/283)
» Spioenkop Farm (Farm 412, 461 & 467);
- Bankfontein Farm (Farm 519.

The farm portions proposed for the site will be leased from the landowners and the homesteads will remain on the site, while the wind energy facility is constructed and operated. Farming activities to continue as usual

6.4.2 Economy

In 2007, the XDM contributed ~3% to the total Provincial GDP. Annual GDP growth has remained relatively stable since 1996 at between 1-4%. A comparison of the Gross Geographic Product (GGP) with the DM's population shows that the GGP per capita is calculated at R4 858, which the second lowest of the Free State districts. Approximately 22% of DM's Gross value Added (GVA) is generated by the primary sector which is

significantly higher than both the Provincial (15%) and National (9%) numbers. The secondary sector contributes ~17% to the GVA of the DM which is on par with the provincial average (17%). The tertiary sector, although relatively undeveloped contributed around 44% while the government sector contributes around 18% to the GVA.

6.4.3 Population

The Xhariep District Municipality accounts for ~5% of the Free State Province's population. The Xhariep District Municipality is home to an estimated 135,225 people (2007[3]). The District has the lowest total population in the Free State Province with population density of ~4/km^2. The Kapanong Local Municipality (KLM) had a population of 55 936 in 2007, accounting for ~41% of the DM's population.

6.4.4 Education

Of all the districts in the Free State, the XDM has the highest percentage of people with no schooling (17.5% in 2001) and also the lowest percentage of people with a post Grade 12 certificate. In 2001, the illiteracy rate for the XDM region was estimated 22.74%, an increase of 1.33% since 1996.

6.4.5 Employment levels

The percentage of economic active people (those between 15 and 60 years of age) in XDM was 59.9% in 2001. This is lower than the provincial average and most likely an indication of the fact that economic opportunities are limited within the DM and that a significant proportion of the population are in employment elsewhere (most likely in the Bloemfontein area), leaving the children and aged in the XDM. Consequently, the XDM has a large percentage of people over the age of 60. In 2005, the XDM experienced a net gain of 1000 jobs since 2001.

6.4.6 Noise and Visual receptors

Thirteen noise-sensitive developments (NSD) / potential noise receptors have been identified on the site and within 2 kilometres from the boundary of facility. The locations of these are illustrated in Figure 6.7. The noise receptors will also correspond with the visual receptors in the area.

[3] The draft SIA report was drafted prior to release of the 2012 Census data

Figure 6.7: Potential Noise Sensitive Developments (green dots) in and around the site (within 2km)

6.5 Heritage and Palaeontological Profile

No sites of heritage potential could be identified in the proposed site for the wind energy facility.

6.5.1 ***Palaeontology***

The development site is situated within the Dicynodon Assemblage Zone (AZ) near the latter's eastern boundary with the Early Triassic sediments of the younger Lystrosaurus AZ (Rubidge 1995).

The Dicynodon Assemblage represents the terminal phase of the Palaeozoic continental biota, that was dominated by therapsid "mammal-like reptiles" and Glossopteris Flora before it was largely wiped out by the end-Permian Mass Extinction Event (Ward et al. 2005). Fossil types from this biozone are listed in Keyser & Smith (1978-79) and Kitching (1995). Therapsids from this biozone occur generally well-preserved in mudrock horizons and are usually found as dispersed and isolated specimens associated with an abundance of calcareous nodules (Kitching 1995). Other vertebrate fossils include palaeoniscoid fish and crocodile-like temnospondyl amphibians.

Overlying Late Cenozoic valley fill deposits may occasionally contain much younger fossil biotas, including the skeletal remains of Quaternary mammals, non-marine molluscs,

and a variety of other microfossils. Geomorphologically the study area is characterised by low hills and koppies often topped by doleritic sills.

The region is relatively fossil rich. Fossils have been found on the farms in the study area. The fossils of the region include fossilised wood and vertebrate skeletal material. The study area falls within the Adelaide Subgroup of the Beaufort Group. Biostratigraphically the study area falls primarily in the *Cistecaphalus* Assemblage Zone although a part of the *Dicynodon* Assemblage Zone may occur in the northern part of the study area (Rubidge, 1995). Although it is difficult to predict where fossils would occur in the mudrock and sandstone of the study area, there is a high probability that fossils would be uncovered when clearing and excavations for foundations, pipelines and roads take place during construction.

Dolerite, being of igneous origin, is devoid of fossils. In addition fossils are usually absent in the sedimentary rocks immediately adjacent to the dolerite intrusions. There is no palaeontological concern in the instances where the proposed construction is situated on dolerite, which would probably be the case with wind turbines which will be constructed on the hill tops.

6.5.2 ***Stone Age***

This region of the Free State is home to all three of the known phases of the Stone Age, namely: the Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are less common in this area, however rock-art sites and Late Stone Age sites are much better known. No stone age sites were identified during the Phase 1 Archaeological Impact Assessment.

6.5.3 ***Built Environment***

Most of the study area falls within an undeveloped rural landscape with little or no built structures. The only built structures expected to be encountered in this area would be farm homesteads and their associated infrastructures. It is not anticipated that any of these structures would be affected by the proposed development. Should the developers decide to utilise any of the existing structures on the site for their operations and this entails alterations to the buildings it is recommended that they subject these to further study before such actions.

*6.5.4 **Rock Art***

Rock art is found in small concentrations in the Southern Free State, however no sites where found on the Springfontein site.

*6.5.5 **Iron Age***

No Iron Age sites are located in the Southern Free State, south of Bloemfontein, in low-lying areas/ on the site.

*6.5.6 **The Historic Era***

The town of Springfontein was established in 1904 on the farm Hartleydale, which was part of the farm Springfontein. The name Springfontein, which is Afrikaans for "jumping spring", stems from the existence of a spring on the farm. A village management board was established in 1904 and the town attained municipal status in 1912. Farming with sheep, cattle and maize is prevalent in the district, and in the early part of the twentieth century the Springfontein Creameries were one of the main employers.

The town is an important railway junction on the main line to Johannesburg, being the point where the Bloemfontein line converges with the East London and Port Elizabeth lines and where a westward line to other Free State towns commences.

The Springfontein area was significant during the South African War due to the location of the largest concentration camp for Boer woman and children. It is estimated that 704 woman and children died in this camp and today over 200 graves are located in the camp cemetery on the perimeter of the town of Springfontein.

There is a possibility of conflict sites from the South African War being located on some of the ridges identified for the placement of the turbines (these are strategic both in military as well as wind energy terms). The location of these sites is often only documented and very little or no evidence was found on the ground.

*6.5.7 **Built Environment***

Most of the study area falls within an undeveloped rural landscape with little or no built structures. The only built structures expected to be encountered in this area would be farm homesteads and their associated infrastructures.

SCOPE OF THE WIND ENERGY FACILITY PROJECT CHAPTER 7

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

7.1 Project Construction Phase

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. A construction workforce will be required. Approximately ~ 265 jobs may be created during the construction phase, as is shown in Table 6.1. As far as possible, local labour will be utilised. The construction phase is anticipated to be between 18 and 24 months in duration.

Table 7.1: Estimated number of jobs that may be created during the construction phase

Labour type	Number of employment opportunities	Locally sourced	Nationally sourced	Internationally Sourced
Unskilled Labour	104	85%	15%	
Semi-Skilled Labour	52	80%	20%	
Skilled Labour	92	5%	80%	15%
Professional	17	1%	80%	29%

7.1.1 Dimensions of Components

The infrastructure required will have the following typical dimensions:

» Turbine foundation/footprint: 20m X 20m
» Gravel surfaced hard standing areas (approximately 2400m^2) adjacent to each turbine. The temporary footprint is shown in Figure 6.1 below.
» A new sub-station (with an approximate compound size of 100 m x 100 m) and a transformer with a connection to the 132 kV Eskom grid will be built.
» A single storey operations and maintenance building- 100 m 100m. Fencing will be erected as required.
» Up to 2 permanent wind measuring mast(s) of 70 m – 120 m (height), lattice structure
» The main construction site compound for all contractors would be approximately 5000 m^2 in extent.

» Lay down area, besides an access route, with a maximum 10,000 m^2 – this hard-standing area could be temporary or if the landowner prefers, left for his use
» All roads width up to 10 m including cabling and drainage cabling and drainage with the inclusion of passing bays where appropriate.

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

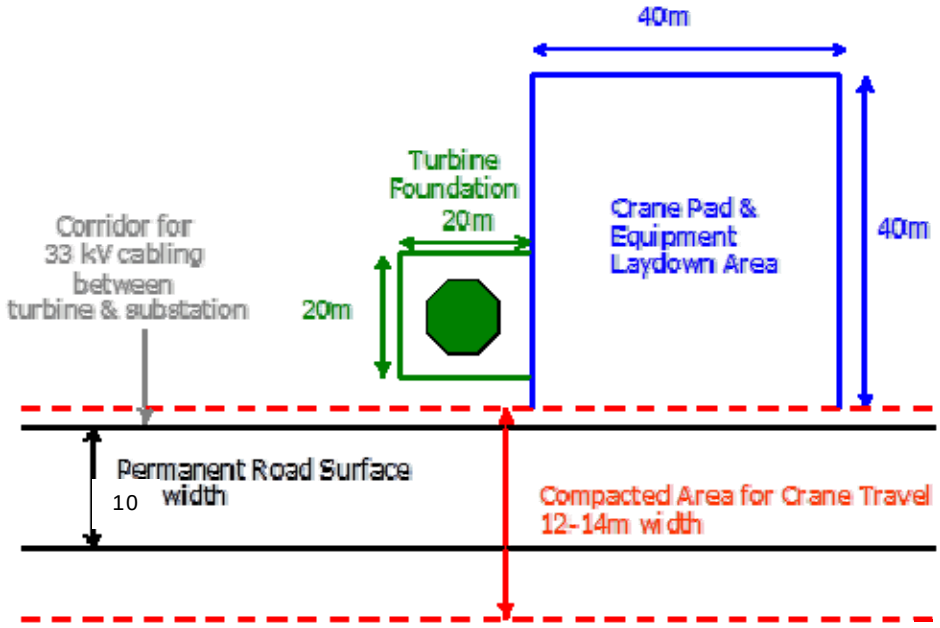

Figure 7.1: Diagrammatic representation of a typical layout of components.

Figure 7.2 illustrates the typical crane hard standing layout.

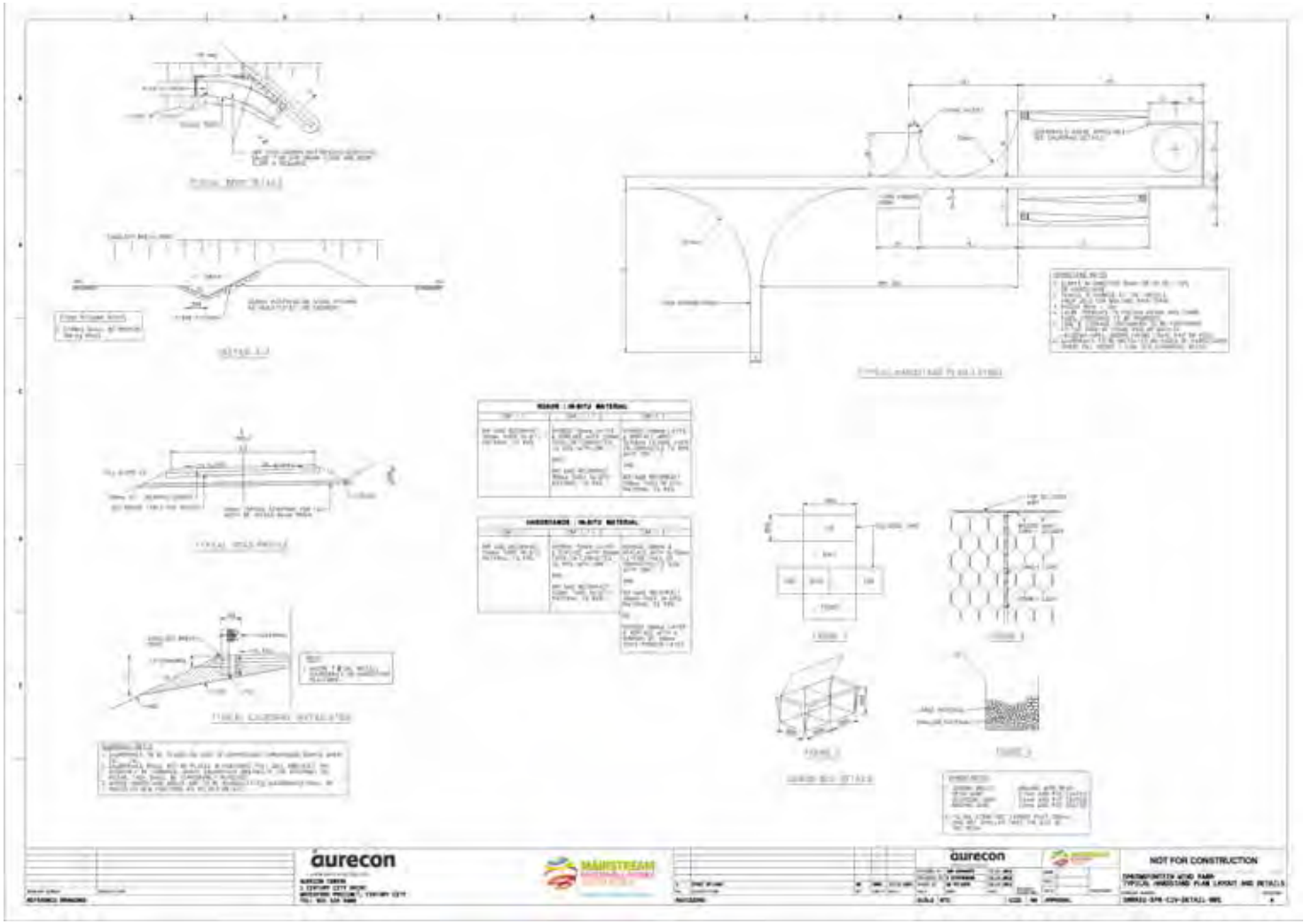

Figure 7.2: Typical Crane Hard Standing Layout

7.1.2 Conduct Surveys

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

7.1.3 Establishment of Access Roads to the Site

The proposed site is currently accessible from the R715 from Springfontein and each farm portion is accessible via existing gravel access roads. The individual farm portions already have a good network of "tracks" and internal roads which will be considered for use by the wind energy facility. Access roads to each turbine are required to be established. As far as possible, existing access roads would be utilised, and upgraded where required. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Special haul roads of up to 10m in width may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines.

These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. It is proposed that in preparing the access road, a portion of it (up to 4m in width) will be constructed as a permanent access road and the remainder as a temporary access road that can be ripped and rehabilitated and returned to its pre-construction condition.

7.1.4 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 6.2.2 above) and excavations for foundations (refer to 6.2.5 below). These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on 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). Borrow pits are not planned, soil will be sourced commercially. There is also a registered quarry on an adjoining site (potential source).

7.1.5 Construction Compound

A temporary construction compound will be required during the construction phases to provide amenities and housing for up to 10 construction workers such as security guards. The construction compound will be ~5 000 m^2 (or 0.5 hectares) in extent. Both preferred and alternative options are located on the Farm Bankfontein 519, just off the gravel road which traverses the farm. Construction of the compound will entail vegetation clearing and setting up offices, amenities (ablutions) and basic services such as electricity.

7.1.6 Construct Foundation

Concrete foundations (20m x 20m)will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 2 m, depending on the local geology. Concrete may to be brought to site as ready-mix or batched on site if no suitable concrete suppliers are available in the vicinity. The reinforced concrete foundation will be poured and will support a mounting ring. The foundation will then be left up to a week to cure.

Figure 7.3: Photograph illustrating the construction of the foundation for a wind turbine[9]

[9]Photo sourced from http://www.news-gazette.com/news/environment/2011-08-16/wind-farm-construction-begins-near-paxton.html

7.1.7 Water Required During Construction

Water will be required during the construction process (for dust suppression, concrete works etc.) and for consumption by the construction work force. Water may be sourced from an on-site borehole and/or purchased from the Local Municipality. An estimated of the quantity of water required for construction is shown in Table 7.2.

Table 7.2: Estimated water volumes required during the Construction Phase

Activity	Quantity (m^3/day)	Duration	Usage (m^3)
General construction activity including concrete works	400	2.5 months	29 600
General construction activity*	300	22.5 months	196 800
Total		**25 months**	**226 400 m^3**

7.1.8 Transport of Components and Equipment to Site

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 Road Traffic Act (Act No 29 of 1989)[10] 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.).

Figure 7.4: Images illustrating transportation of wind turbine components via road[11]

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

[11] Images sourced from: windpowerninja.com and renewableenergyfocus.com

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.

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

Figure 7.5 show the planned route for the transportation of the wind turbines from the Port of Ngqura (in Port Elizabeth) along the N010 to Springfontein.

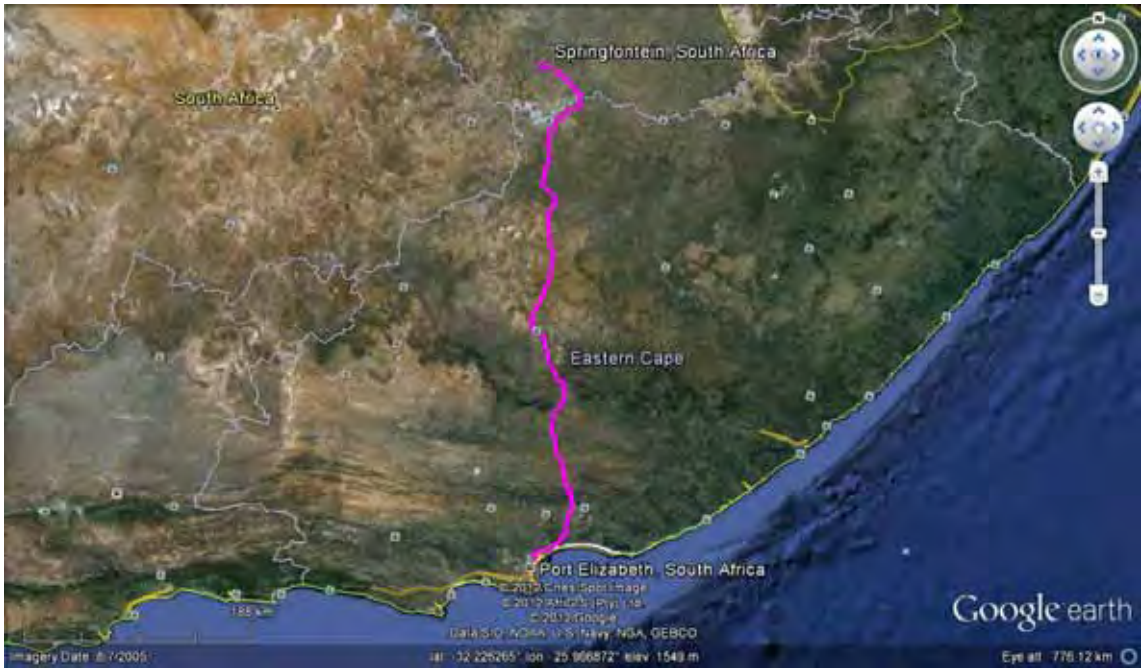

Figure 7.5: Proposed Transport route

7.1.9 Establishment of Laydown Areas on Site

Laydown areas/yard will be required on the site. Laydown and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. Laydown areas will also need to be established at each turbine position for the storage and assembly of wind turbine components. The turbine laydown area will need to accommodate the cranes required in tower/turbine assembly. The extent of one turbine laydown area is up to 2400m^2.

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

7.1.10Construct Turbine

A large lifting crane will be brought on site. It will lift the tower sections into place. The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. It will then be lifted to the nacelle and bolted in place. A crane will likely be needed for the assembly of the rotor while a large crane will be needed to put it in place.

7.1.11Construct Substation

A substation will be constructed within the site development footprint. The turbines will be connected to the substation via underground cabling wherever possible. The position of the substation has been informed by the positioning of the wind turbines. The substation is proposed on the Remaining Extent of Farm Stock Port 283.

The construction of the substation would require a survey of the site; site clearing and levelling and 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 and protection of erosion sensitive areas.

7.1.12Connection of Wind Turbines to the Substation

Each wind turbine will be connected to the on-site substation via underground cabling wherever 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.

7.1.13Connect Substation to Power Grid

A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:

» **Preferred Grid Connection Option**
The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop-out 132 kV power line configuation of up to 500m in length, is proposed.

» **Alternative Grid Connection Option:**
The alternative grid connection option includes building a new 132 kV substation on the Remaining Extent of Farm Stock Port 283as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockport). The length of this new power line would be ~4200m.

A route for the power line will be assessed, surveyed and pegged prior to construction.

7.1.14Commissioning

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.

7.1.15Undertake Site Remediation

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

7.2Project Operation Phase

An artist's impression of a typical wind energy facility, illustrating the various components and associated infrastructure is shown in Figure 7.6. Approximately 17-20 technical and general maintenance staff will be required. It is anticipated that there could be security and maintenance staff required on site. Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions or maintenance activities.

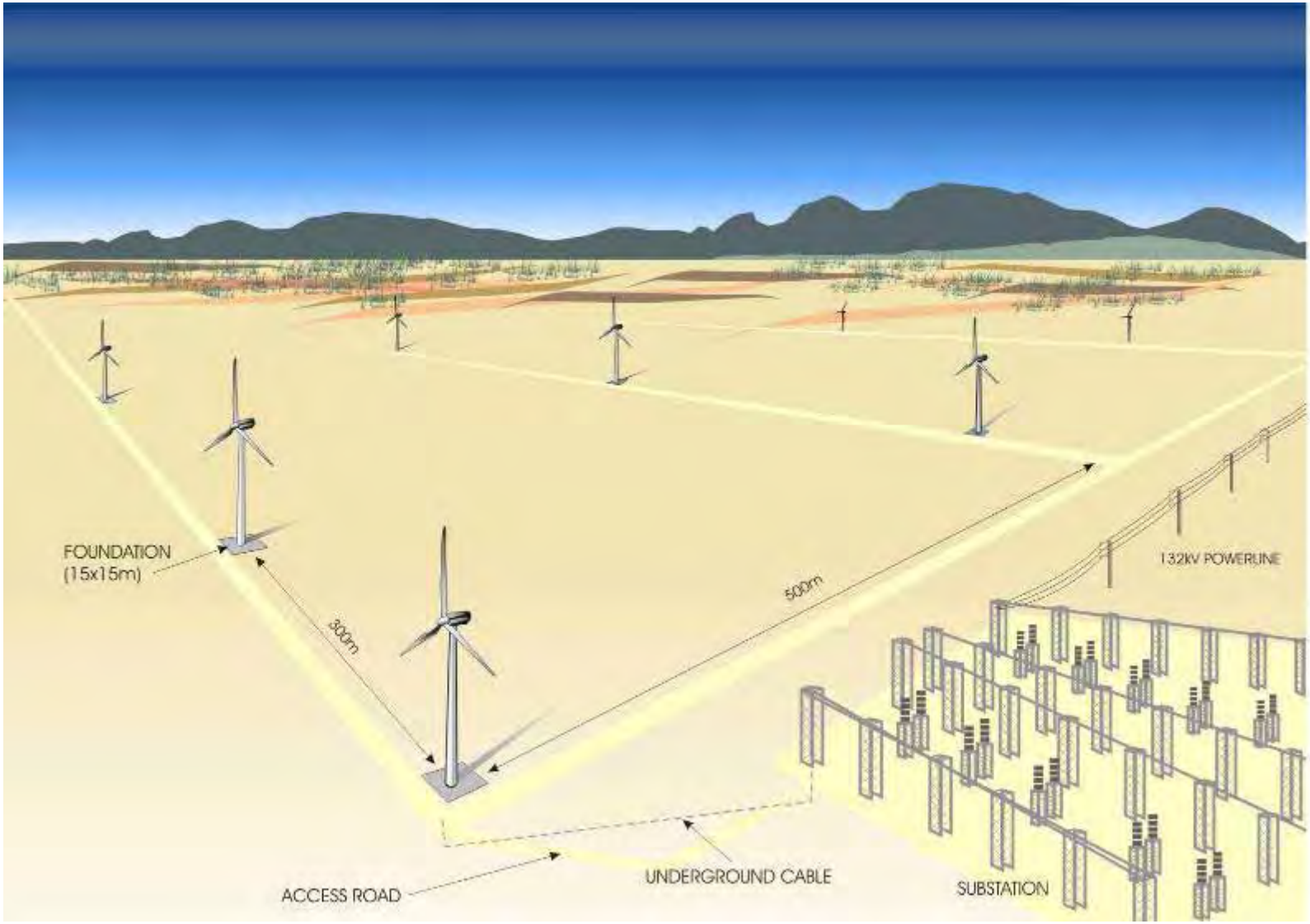

Figure 7.6: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

7.2.1 Maintenance & Staff

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. Approximately 17-20 technical and general maintenance staff will be required. Table 7.4 shows the estimated number of staff that will be required for the maintenance and operations of the facility.

Table 7.4: Estimated number of staff required for the operation of the wind energy facility

Labour type	Number of employment opportunities	Locally sourced	Nationally sourced
Operation Phase (20-25years)			
Unskilled Labour	10	90%	10%
Semi-Skilled Labour	3	90%	10%
Skilled Labour	4	25%	60%

7.2.2 Water required during Operations

Once construction and commissioning is complete, the wind energy will begin to produce electricity for a period of 20 years. It is worth noting that modern day wind turbines require only relatively small amounts of regular maintenance which will be handled by operations and maintenance team (an estimated 17 employees) with many functions being able to be monitored remotely. Anticipated water usage for the operations stage is estimated to be in the range of 766 – 1 000 kilolitres per annum purely for domestic water purposes e.g. sanitation, washing and drinking. It is worth highlighting that, as a technology, wind power uses less water than almost any other power generation technology.

Table 7.5: Estimated number of water required for operation of the wind energy facility

Activity	Quantity (m^3)	Duration	Yearly (m^3)
Operational phase	1000	1 years	1000
TOTAL		**20 years**	**20000**

7.3 Decommissioning

The turbine infrastructure which will be utilised for the proposed project is expected to have a lifespan of approximately 20 - 30 years (with maintenance). Generally a power purchase agreement of 20 years is signed with the energy buyer. After the

PPA comes to an end the PPA may be renegotiated at terms that is financially viable at that point in time. The PPA may be based on a shorter term agreement using the existing turbines (if the existing turbines are still suitable) Or a new longer term PPA may be negotiated based on re powering (refurbishment) of the wind farm. It is most likely that refurbishment of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time. New turbine technology may also reduce potential environmental impacts. Where no new PPA can be negotiated it is likely that the wind farm will be decommissioned as required in the EMP. LUPO and regulations of that time.

The following decommissioning and/or repowering activities have been considered to form part of the project scope of the proposed wind energy facility.

7.3.1 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.

7.3.2 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. The land-use will revert back agriculture/ grazing.

ASSESSMENT OF IMPACTS: CHAPTER 8

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

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

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

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

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, power line, access road/s to the site, internal access roads between turbines, underground electrical cabling between turbines, turbine foundations), and to make recommendations regarding preferred alternatives for consideration

by DEA, as well as for the management of the impacts for inclusion in the draft Environmental Management Programme (refer to **Appendix O**).

In order to assess the impacts associated with the proposed Springfontein wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. The study area for the Springfontein site (approximately 83 km^2) is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated in **Figure 8.1** below, and includes the area covered by the following six farm portions:

» Remaining Extent of the farm Stock Port 283;
» The farm Bankfontein 519;
» The farm Mistkuil. 412;
» The farm Ou Spioenkop 467 and
» The Remaining Extent of the farm Spioenkop 461

The project will include the following infrastructure:

» The site is proposed to accommodate up to 74 wind turbines. The facility would be operated as a single facility with each turbine being between 1.4 MW and 4 MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 2m), a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades.
» Internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (100 m x 100 m) to facilitate grid connection.
» A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:
    o **Preferred Grid Connection Option**
      The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop out 132 kV power line of up to 500m in length, is proposed.
    o **Alternative Grid Connection Option:**

The alternative grid connection option includes building a new 132 kV substation on farm Stock Port RE/283 as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockpoort. The length of this new power line would be ~4200m. The proposed substation will have a high-voltage (HV) yard footprint of approximately 100m X 100m.

» Up to 2 permanent wind measuring mast(s) of 70 m – 120 m (height), lattice structure
» The main construction site compound for all contractors would be approximately 5000 m^2 in extent.

The assessment presented within this chapter of the report is on the basis of a preliminary layout provided by Mainstream. This layout indicates **74 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies attached within **Appendices F – N**) considers the worst-case scenario in terms of potential impacts. The position of the substation (and the alternative substation position) is directly related to the point of connection to the Eskom grid.

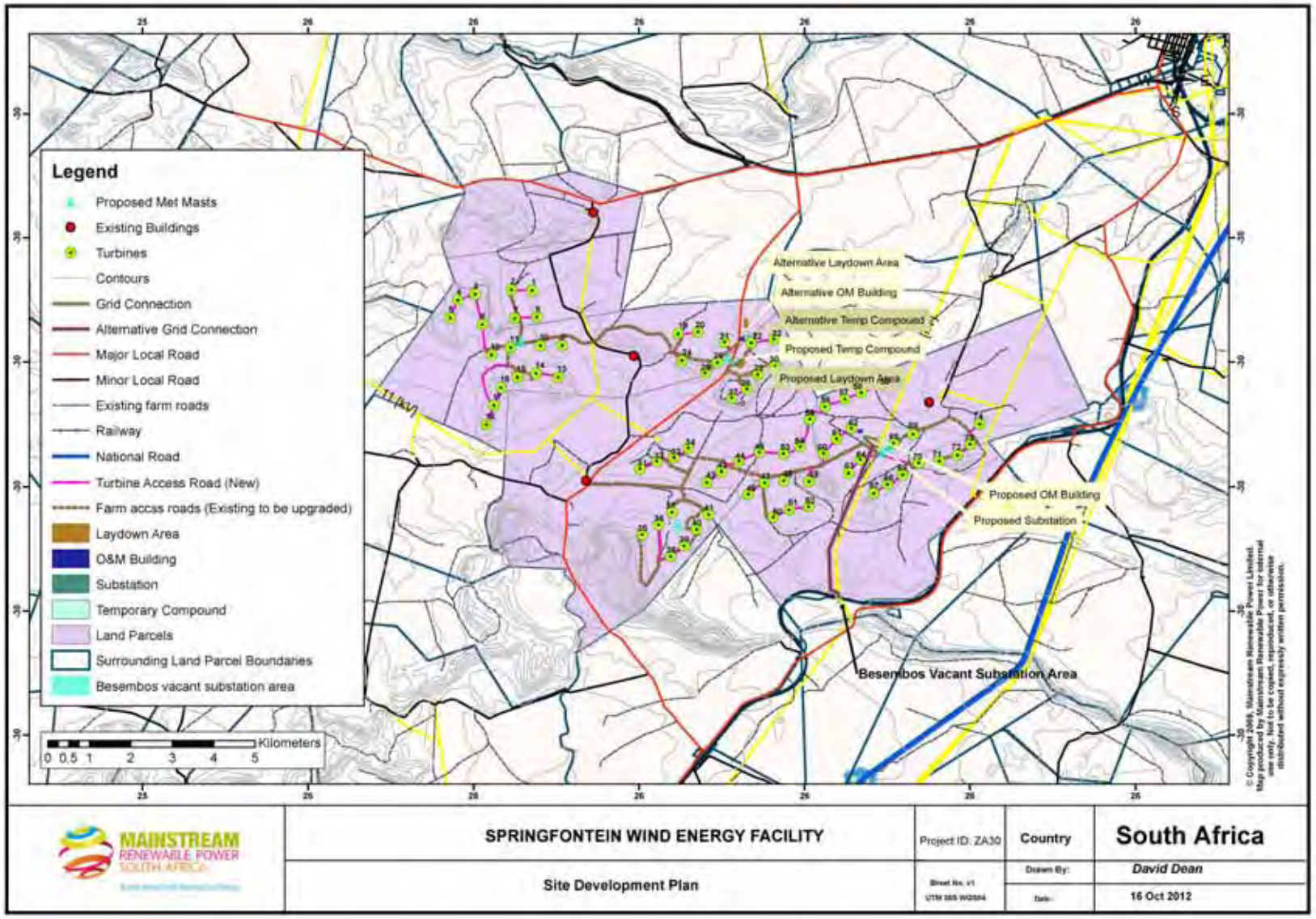

Figure 8.1: Layout map showing the technical design and layout of the Springfontein Wind Energy Facility

8.1 Assessment of Potential Impacts on Ecology

Potential ecological impacts resulting from the development of a wind energy facility at the Mainstream Springfontein site would stem from a variety of different activities associated with the construction and operational phases of the project including the following:

» Construction Phase
  * Vegetation clearing and site preparation
  * Operation of heavy machinery at the site
  * Human presence
» Operational Phase
  * Site maintenance activities
  * Human presence
  * Operation of the turbines

The above activities may result in the following impacts on ecology:

» Impacts on vegetation and listed plant species
» Faunal impacts
» Increased alien plant invasion risk
» Increased soil erosion risk
» Reduced landscape connectivity

These impacts are discussed and assessed in the subsections below.

Overall, although there are some sensitive habitats present on the site which should be avoided, these are limited in extent. The majority of the site is of low sensitivity and is suitable for development of the wind energy facility, with a low potential of significant terrestrial ecological impact. The ecological sensitivity map for the Mainstream Springfontein site is provided in Figure 8.2. The areas of ecological sensitivity include:

» Drainage lines: According to the National Water Act a watercourse'' means-
  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks. There is one non-perennial river (the Donkerpoortspruit) which transects the site. The non-perennial river has been buffered at 200m and it is recommended that no infrastructure be placed in this drainage line, as avoidance of impacts is preferred. Drainage lines also occur on the site. These areas are considered sensitive ecosystems and should be avoided as far as possible. The drainage features have largely been

avoided by the provisional layout. Where turbines fall within drainage areas, these positions can be adjusted slightly to avoid the sensitive area.

» Large rocky hills in the southern portion of the site and the steep south-facing slopes along some of the lower rocky hills: There are a number of turbines in close proximity to some of the areas identified as important south-facing slopes. As many of these areas are very narrow or limited in extent, minor adjustment of the turbine positions would usually be sufficient to avoid the sensitive areas. Development in proximity to these areas should, however, proceed with caution and additional precautions to ensure that impacts on sensitive habitats as well as on protected and listed plant species are minimised, may be necessary. .

Those turbines within the plains are generally not of great concern given the homogenous nature of the habitat and the associated low ecological risk associated with development in these areas.

The wind turbines which are within potentially ecologically sensitive areas and whose locations should be adjusted to minimise the potential for impacts of high significance include the following:

» Turbines 1, 3, 19, 22 and 41 are within minor drainage lines or areas which experience water flow during wet events, and should be relocated to the area adjacent to the drainage area.
» Turbines 67, 68, 69, 70 are within or in close proximity to sensitive south-facing slopes and should also preferably be relocated, either off the slope or onto the north-facing slope.

Protected Plant Species of Conservation Concern known to occur in the vicinity of the Mainstream Springfontein Wind Energy Facility are listed below in Table 8.1. Although some of these species may occur at the site, none of these species were observed during the site visit. Apart from the listed species, a number of provincially protected species were present including *Aloe broomii*, *Ammocharis coranica* and *Euphorbia clavarioides* var. *clavarioides*.

Table 8.1. IUCN status of plant species recorded from the vicinity of the proposed Mainstream Springfontein Wind Energy Facility, based on the SANBI SIBIS database.

Family	Species	Status
ASTERACEAE	*Gnaphalium declinatum*	NT
FABACEAE	*Aspalathus intricata subsp. intricata*	Rare
PORTULACACEAE	*Anacampseros subnuda subsp. lubbersii*	VU
LAMIACEAE	*Salvia repens var. keiensis*	DDD

ASTERACEAE	*Senecio glutinarius*	DDT
MESEMBRYANTHEMACEAE	*Nananthus vittatus*	DDT
GERANIACEAE	*Pelargonium sidoides*	Declining

In terms of the NEM:BA a permit (a TOPS permit) is required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Free State Nature Conservation Ordinance.

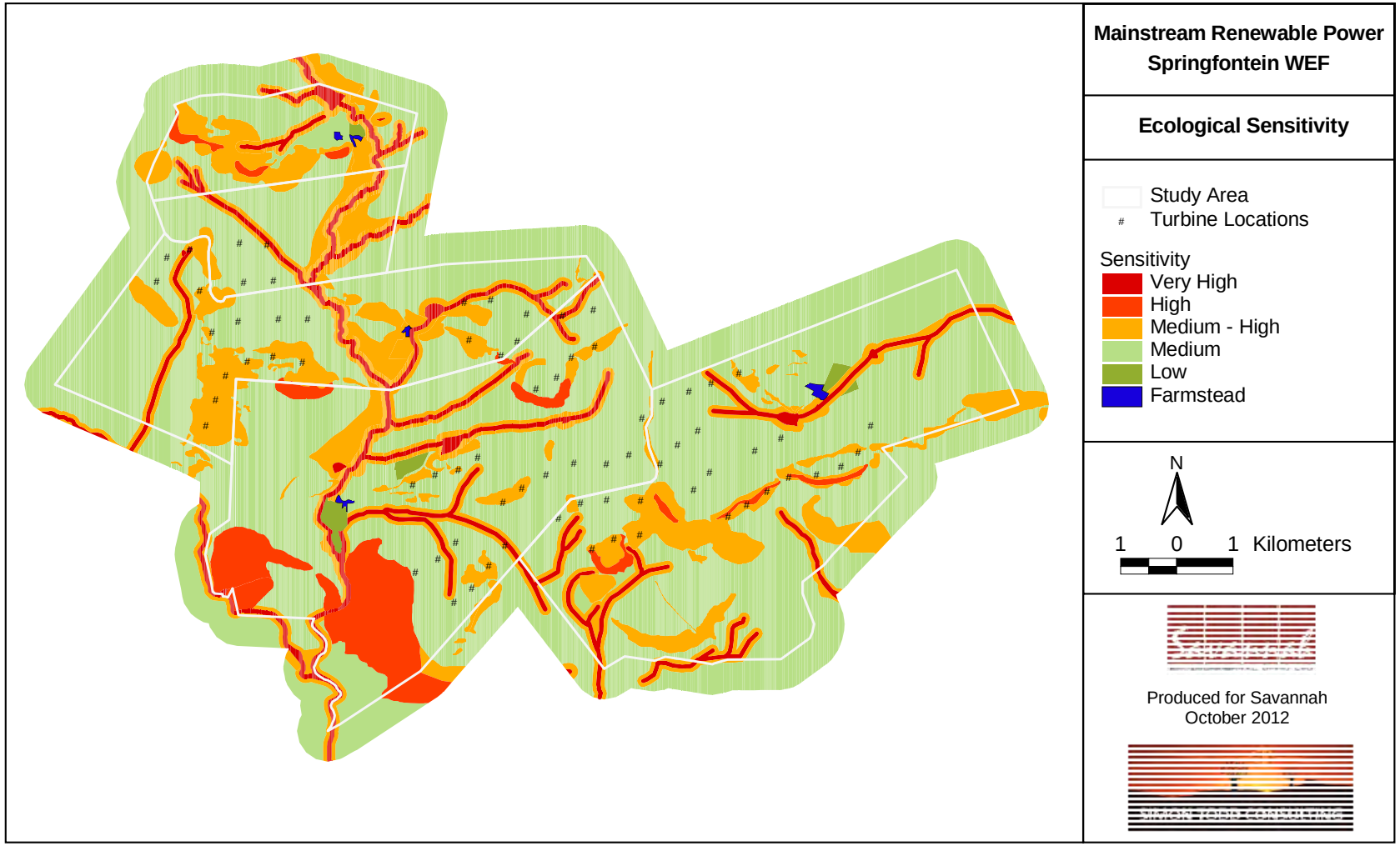

Figure 8.2: Ecological sensitivity map for the Springfontein wind energy facility site, illustrating the location of sensitive vegetation, drainage lines (including a reasonable buffer), and south-facing slopes

8.1.1 Impacts on vegetation and protected plant species

Some loss of vegetation is an inevitable consequence of development. The roads required to be constructed are likely to generate the bulk of this impact. Although there are not many red-data listed or protected plant species at the site, there are some sensitive habitats present that would be vulnerable to impact, especially the drainage lines , Donkerpoortspruit, and south-facing slopes.

Impact Table - Impact on vegetation and protected plant species

***Impact Nature**:* Impacts on vegetation and protected plant species would occur due to the construction of the facility.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (2)
Magnitude	Medium (6)	Low (3)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Low (21)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	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, 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 EMPr for the development.		
Cumulative Impacts The potential for cumulative impacts is considered to be low as the receiving vegetation types are still largely intact and there are few large-scale or similar developments in the area.		

Residual Impacts
Some loss of vegetation is inevitable and cannot be avoided

8.1.2 Impacts on Watercourses / Drainage Lines

Construction may lead to some direct or indirect loss of or damage to drainage lines or impacts that affect the catchment of these watercourses. Without mitigation, this could lead to localised loss of riparian habitat and may lead to downstream impacts that affect a greater extent of the watercourses or impact on their functioning. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat.

The majority of the wind turbine layout avoids drainage lines present on the site. However turbines 1, 3, 19, 22 and 41 are within minor drainage lines or areas which experience water flow during wet events and should be relocated to the area adjacent to the drainage area.

Impact Table - Impact on Watercourses/ Drainage Lines

Nature: Damage to drainage lines on the site		
	Without mitigation	**With mitigation**
Extent	Local And Surroundings (2)	Local And Surroundings (2)
Duration	Long-Term (4)	Short-Term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible To Some Degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Control stormwater and runoff water and inhibit erosion. » Disturbed areas must be rehabilitated as soon as possible. » Align internal access roads so that they branch directly from existing roads and avoid traversing drainage lines as far as possible. where this is not possible, then the following measures must be applied: • Obtain a permit from DWA to impact on any water resource.		

• Cross watercourses close to existing disturbances. • Adequate culvert and/or bridge structures are required at crossings.
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on riparian habitats that will exacerbate this impact.
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

8.1.3 Impacts on threatened animals and associated habitat

The mammalian community at the site is likely to be of moderate to high diversity with as many as 51 terrestrial mammals potentially occurring at the site. A relatively large number of species were directly or indirectly observed at the site, including, South African Ground Squirrel, Namaqua Rock Mouse, Saunders' Vlei Rat, Smith's Red Rock Rabbit, Aardvark, Bat-eared Fox, Yellow Mongoose, Cape Hare, African Mole Rat, Cape Porcupine, Rock Hyrax, Marsh Mongoose, Steenbok and Black-backed Jackal. Springbok and Blesbok were also present as introduced species on all of the study farms. Apart from the species observed at the site, a large proportion of the species with ranges that include the site are likely to be present on account of the range and variety of habitats present.

Four species of conservation concern potentially occur at the site, these are the White-tailed Mouse *Mystromys albicaudatus* (Endangered), Brown Hyaena *Hyaena brunnea* (Near Threatened), Leopard *Panthera pardus* (Near Threatened) and Black-footed Cat *Felis nigripes* (Vulnerable). The Leopard and Brown Hyaena are not likely to occur or be abundant in the area on account of the agricultural land-use in the area which is not usually highly tolerant of large carnivores. The White-tailed Mouse may however occur at the site as the habitat is broadly suitable. The Black-footed Cat is a secretive species which would probably also occur at the site given that it occurs within arid, open country. As the development would comprise a very small area relative to the extensive national ranges of these species, the impact of the development on habitat loss for these species would be very low when considered at a broad scale.

Faunal impacts are likely to most intense during the construction phase of the development on account of the large amount of physical and noise disturbance generated at this time. The presence of large number of construction personnel will also lead to increased 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. During the operation phase, the major impacts are likely to stem from residual habitat loss resulting from the transformation of habitat as well as increased predation risk for some species.

Impact Table - Impact on threatened animals / habitat

***Impact Nature**:* Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Some aspects such as those relating to human activity can be mitigated, but habitat loss cannot be mitigated.	
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 firewood collection 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 development would contribute to cumulative habitat loss for fauna, but the contribution would be very small and is not considered significant.		
Residual Impacts Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.		

8.1.4 Establishment of declared weeds and alien invader plants

Disturbance created at the site during construction would leave the site vulnerable to alien plant invasion. A wide variety of alien species are already present at the site and so it would be very difficult to prevent some of these species from taking advantage of the

disturbance created during the construction phase of the development. The new access roads would also encourage the spread of alien species across the site and could potentially lead to invasion of currently intact areas.

Impact Table - Alien vegetation growth due to disturbance

Impact Nature: Alien plants are likely to invade the site as a result of disturbance created during construction		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**Low (21)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
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 to be developed following a walk through survey of the proposed infrastructure, it should aim to address alien plant problems within the whole site, not just the development footprint.		
Cumulative Impacts Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant.		
Residual Impacts If alien species at the site are controlled, then there will be very little residual impact		

8.1.5 Vegetation and Habitat Loss due to Access Roads

The extensive road network required to access the turbine positions is likely to amount to about
50 km of hardened access roads. Access roads will entail clearing of vegetation, therefore vegetation loss and habitat loss for plant species. Creation of access roads causes nodes of

disturbance, and may become hotpots for soil erosion. This impact could occur on the site, and presents a risk particularly on steep slopes and hills, where turbines are proposed. Some access roads may inevitably cross drainage lines, which may cause cumulative downstream effects on watercourses. Therefore the impact of access roads, without environmental control measures may be of a high significance and with mitigation this impact could be manageable. This may have some impact on landscape connectivity for fauna which avoid traversing open areas or are vulnerable to predation in the open. Slow moving species such as tortoises and some snakes are vulnerable to this impact. 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, but non-resident fauna may avoid the area on account of the noise generated by the turbines.

Impact Table – Impact of access roads on ecology

Nature: Loss of habitat within indigenous natural vegetation types, disturbance and soil erosion due to creation of permanent access roads.		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate (5)
Probability	definite (5)	probable (3)
Significance	**medium (60)**	**medium (33)**
Status (positive or negative)	negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: » Internal access roads must make use of existing roads on site, as much as possible. Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas. » Avoid unnecessary impacts on natural vegetation surrounding the turbines. The construction impacts must be contained to the footprint of the turbine and laydown area. » Disturbed areas must be rehabilitated as quickly as possible.		
Cumulative impacts: Soil erosion, alien invasions, damage to watercourses may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of natural vegetation type is likely to occur, but only a small extent is potentially at risk.		

8.1.6 Comparative Assessment of Alternatives

In terms of the different development options, the following locational alternatives are identified as the preferred alternatives:

» Regarding the grid connection options, the option which results in the shortest length of new power line would be the preferred option. This would be the loop-in loop-out connection from the on-site substation to the Besembos-Signal 132kV line.
» The preferred substation and O&M Building are preferable to the alternative locations on account of the proximity of the alternative locations to sensitive areas.
» The laydown and temporary camp locations are acceptable and preferable to the alternative locations, but either would be acceptable.

8.1.7 Cumulative impacts

To some extent a cumulative impact is a regional impact, rather than the local site scale impact, i.e. if something has a regional impact it also has a cumulative impact. Cumulative impacts for this assessment will include any approved wind energy facilities in the area. There are no other proposed/ approved wind energy facilities in close proximity to the Springfontein site.

Cumulative ecological impacts are therefore expected due to the additive effect on several (74) turbines on the site and are expected to be of a moderate significance and include cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion), and can be effectively mitigated through sound environmental management (mitigation measures) during construction and operation covered in the EMP and by formal conservation and active management of the natural areas on site. With the implementation of this mitigation, cumulative impacts on ecology as a result of the establishment of the project are of an acceptable level.

8.1.8 .Conclusions and Recommendations

Although there are some sensitive features present at the site, such as the a non-perennial river, and drainage lines and south-facing slopes, the majority of the site is not of high ecological sensitivity. Development outside of the sensitive areas is not likely to generate significant ecological impact after mitigation. The major avoidance measure that should be implemented is to avoid the non-perennial river, drainage lines and south-facing slopes as much as possible. The primary focus of active mitigation should be on reducing the erosion and alien plant invasion risks associated with the development. Provided that the recommendations and mitigation measures suggested are implemented, then it is highly

unlikely that the development of the Mainstream Springfontein Wind Energy facility would result in significant degradation of the receiving environment or a net loss of biodiversity at the landscape scale.

The following pertinent recommendations are made:

» The wind turbines which are within potentially ecologically sensitive areas and whose locations should be adjusted include:

  * Turbines 1, 3, 19, 22 and 41 are within minor drainage lines or areas which experience water flow during wet events and should be relocated to the area adjacent to the drainage area.
  * Turbines 67, 68, 69, 70 are within or in close proximity to sensitive south-facing slopes and should also preferably be relocated, either off the slope or onto the north-facing slope.

» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

» Undertake a final survey of the area once final infrastructure positions are known to confirm the presence of possible roosting or foraging habitat for bats. If deemed necessary on the basis of the final survey, implement a bat monitoring programme to document the impact on bat species. If any threatened animal populations are found in these areas, move infrastructure to avoid impact as far as possible.

» No TOPS species where identified on the site during the felid survey. Should TOPS species be identified during the final ecological survey, in terms of the NEM:BA a permit (a TOPS permit) will be required for any activities/ removal of TOPS listed species.

» Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Free State Nature Conservation Ordinance.

» Establish an on-going monitoring programme to detect and quantify any alien plant species that may become established as a result of disturbance.

» Implement mitigation measures as stipulated in the EMPr.

» Appoint an ECO during construction.

8.2 Assessment of Potential Impacts on Avifauna

A pre-constriction bird monitoring programme is currently underway for the site as well as a control area. The data from the bird monitoring has been considered in the avifaunal study (refer to Appendix G). Investigation of this study area and development footprint revealed the following bird micro-habitats on the site:

» Rivers or streams and drainage lines: The site is in a very dry area, with no large or permanent river traversing the site.
» Pastures and arable or cultivated land: Arable or cultivated land represents a significant feeding area for many bird species. Arable lands are scarce in this study area, usually only near to farm housesand dams.
» Dams.
» Bushveld and Thickets: Narrow strips of thicket may exist in the study area, most likely associated with rivers, streams and drainage lines, as well as on the slopes of some hills.
» Hills, Ridges and Cliffs: Rocky ridges that run approximately east to west are also present in the south-east, centre and north-west of the study area. Cliffs, Ridges and Hills represent important habitat for a number of species.
» Grassy Shrublands and Shrublands: Along with grasslands, this was found to be the most abundant micro-habitat on site
» Grasslands: As the majority of the site is classified as “Xhariep Karroid Grassland”, grasslands were indeed found to be an extensive avifaunal micro-habitat on site. Grasslands represent a significant feeding area for many bird species.

Figure 8.3 shows the locations of sightings of relevant large terrestrial species and raptors made by the bird specialist when in the field. Note that this is supported by the field data collected through the pre-construction bird monitoring programme being undertaken on the site. Various nest sites were also identified during the study primarily through consultation with local birders. Nest site N2 is particularly relevant, as it is still used by Verreaux’s Eagle, and is located approximately one kilometre away from the nearest proposed turbine (Turbine 35).

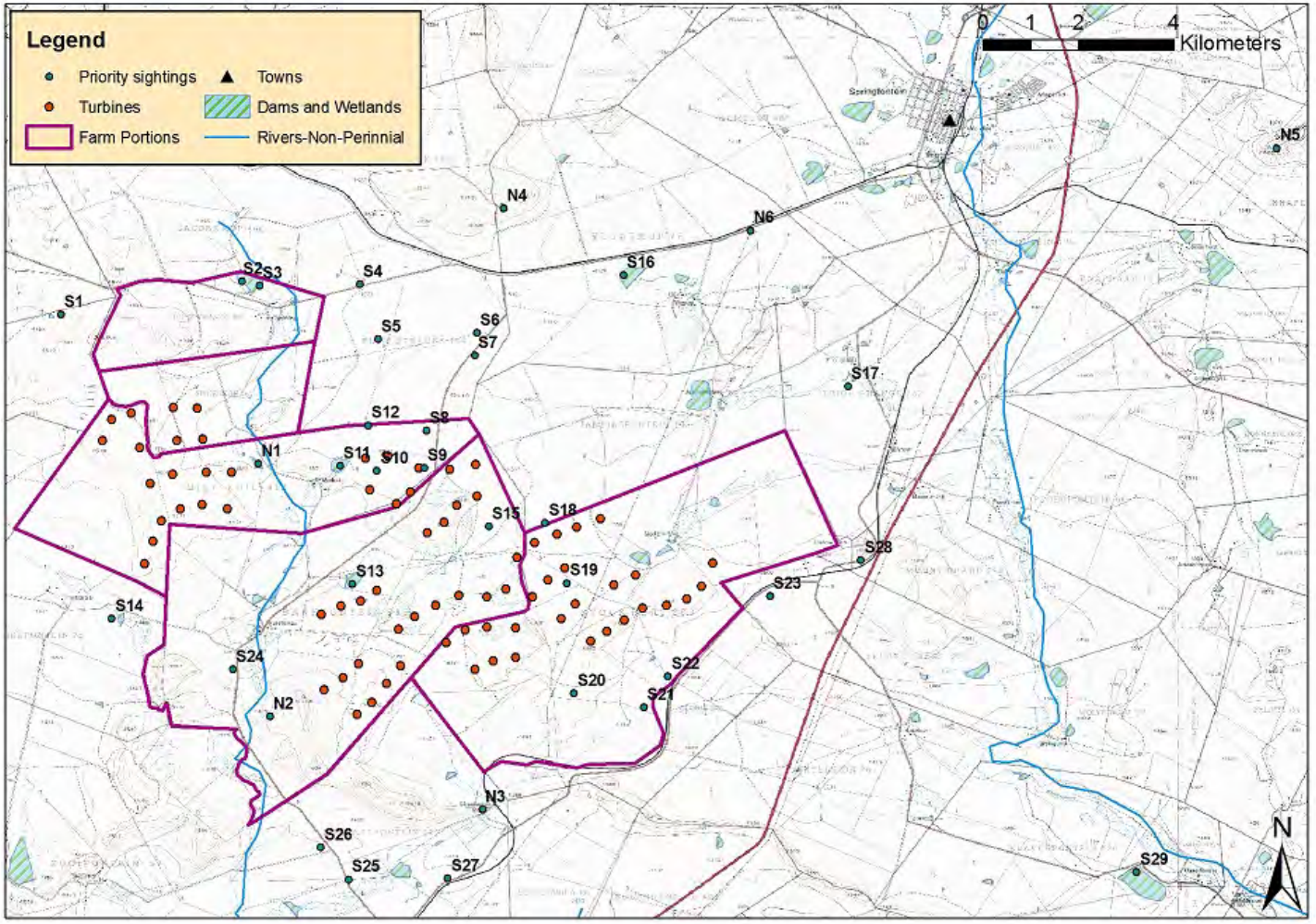

Figure 8.3: Map showing locations of sightings (S1 – S29) of relevant large terrestrial species and raptors made by the EWT during the field survey. Identified nest sites of certain raptors are also shown (N1 – N6). See description and Table 8.2 below.

Map ID	Species	Number	Behavior	Height
S1	Blue Crane	2	Foraging	-
S2	Blue Crane	2	Foraging	-
S3	African Fish Eagle	1	Perched	-
S4	Blue Crane	2	Foraging	-
S5	Blue Crane	2	Foraging	-
S6	Blue Crane	3	Foraging	-
S7	Blue Korhaan	3	Flushed	10m
S8	Ludwig's Bustard	1	Flying Commute	15m
S9	Blue Korhaan	6	Flushed	10m
S10	Blue Crane	2	Foraging	-
S11	Blue Crane	10	Dam roost	-
S12	Blue Crane	2	Foraging	-
S13	Blue Crane	2	Foraging	-
S14	African Fish Eagle	2	Perched calling	-
S15	Ludwig's Bustard	1	Foraging	-
S16	Blue Crane	15	Dam roost	-
S17	Greater Flamingo	20	Flying Commute	60m
S18	Blue Crane	6	Foraging	-
S19	Blue Crane	2	Foraging	-
S20	Blue Crane	2	Foraging	-
S21	Blue Crane	7	Foraging	-
S22	Blue Crane	4	Foraging	-
S23	Secretarybird	1	Foraging	-
S24	Verreaux's Eagle	1	Soaring	75m
S25	Blue Crane	3	Foraging	-
S26	Blue Crane	2	Foraging	-
S27	Blue Crane	2	Foraging	-
S28	Greater Kestrel	2	Soaring	50m
S29	Greater Flamingo	12	Foraging	-
	Nests	*Visually confirmed Y/N*		
N1	Black-shouldered Kite	Y		
N2	Verreaux's Eagle	Y		
N3	Verreaux's Eagle	N		
N4	Verreaux's Eagle	N		
N5	Verreaux's Eagle	N		
N6	Greater Kestrel	Y		

Table 8.2: Key to Sightings

The resultant list of focal species for this study is as follows: Cape Vulture, Tawny Eagle, Verreaux's Eagle, Lesser Kestrel, Black Harrier, Lanner Falcon, Ludwig's Bustard, Blue Crane, Secretary Bird, Blue Korhaan, Greater Flamingo, Namaqua Sandgrouse, Eastern Clapper Lark, Reed Cormorant, African Spoonbill, Melodius Lark and White Stork. In some cases, these species serve as surrogates for other similar species which also may be impacted upon, examples being Verreaux's Eagle for Martial Eagle, Ludwig's Bustard for Kori Bustard and White Stork for Black Stork. The impact of most concern for these species is that of collision with turbines. Of these species, the Raptors, Ludwig's Bustard, Blue Korhaan and Blue Crane are perhaps of most concern, not only in terms of collision with turbines, but also collision and electrocution on associated power lines, and the less direct impact resulting from the wind farm clusters forming barriers to the bird's movement within this area (i.e. habitat disturbance). Also, numerous Lark, Pipit and Cisticola species are present on site, many of which have aerial displays or vocalise while flying at great heights, and may be impacted upon. Assorted more common species will also be relevant to this study, but it is believed that the above focal species will to a large extent serve as surrogates for these in terms of impact assessment and management.

In general the site is moderately to highly sensitive in terms of avifauna, based on the occurrence of a number of listed species in the study area, as well as the various micro-habitats available to avifauna. The area is generally undisturbed and many natural habitats still exist. The high, medium and unknown sensitivity zones are mapped and described below and shown in Figure 8.4.

The sensitivity categories are described below and are colour-coded with the buffers in the Avifauna sensitivity map(Figure 8.5). The categories were assigned using the following factors:

High sensitivity:

The high sensitivity zones are indicated by Red on the map. They include a 200m buffer around drainage lines, a non-perennial river and/or farm dams, as well as 200m buffer around prominent ridges identified at a desk top level, and whilst on site during the site visit. Known Verreaux's Eagle nests were also buffered by 2km, based on consultation of another wind energy facility avifaunal study (Jenkins, 2010) in a similar habitat, as well as personal conversation with Lucia Rodrigues and Dr. Andrew Jenkins (Pers Con, 2012) as well as a five year study of Verreaux's Eagles in the Beaufort West area by Dr Rob Davies (Davies, 1994). Davies (1994), shows that foraging behavior is usually linked with slopes and mountains, while the ranges of four Verreaux's Eagles pairs in the Beafort West area of the Karoo varied from 10.5km^2 to 50.1km^2 . Therefore this 2km buffer is not intended to exclude turbines from the entire foraging range of the nesting eagles, but rather to give breeding eagles some measure of protection by excluding the development from a core area of activity around each nest (Pers Con, Andrew Jenkins 2012). At this stage it is

recommended that placement of turbines in these zones be avoided (which has been considered in the layout of the facility). These areas require special consideration during bird monitoring, which should inform the final micro siting of the wind turbines. If the analysis of robust 12 month monitoring data shows these areas to be less sensitive than predicted here, turbines may be allowed in these zones subject to the approval of the avifaunal specialist. The confidence with which these "High sensitive" areas were identified was medium.

Medium Sensitivity: 

The medium sensitivity zones are indicated by Orange on the map, and include a 200m buffer around streams observed during the site visit, as well as a non-perennial river. Additional zones are outlined in orange in the map above (and are not necessarily related to a landscape item such as a stream or a ridge), which were deemed sensitive based on site observations and experience of the specialist. Areas within these outlines are also classed as medium sensitivity (e.g. turbines 19 and 20 fall within a medium sensitivity zone). It is recommended that turbines and other infrastructure should not be built within these areas where possible. However, subject to birf monitoring results, construction of infrastructure may be possible in these areas and they are preferred over the high sensitivity zones for the placement of turbines.

Unknown Sensitivity:

These are all the remaining areas, and are not color coded on the map. No obvious avifaunal features or patterns could be identified during the study, and it is likely that the majority of these areas could be designated as Low sensitivity. However some areas could be designated as Medium to High sensitivity, in the future upon availability of new data and/or following the completion of the 12 months pre-construction monitoring. At this stage (without suitable monitoring data) there is no good reason that infrastructure should not be built in these areas. Therefore, these unknown sensitivity areas are preferred for construction of wind turbines and associated infrastructure.

Table 8.3 below shows a breakdown, per farm, of turbines that fall either within High or Medium sensitivity zones, and are therefore subject to the above recommendations.

Table 8.3 – Turbines that fall either within High or Medium sensitivity zones

Farm	Sensitivity Zone	Turbine Numbers	Count
Spionkop RE/461	HIGH	-	0
	MEDIUM	-	0
Mist Kuil 0/412	HIGH	3, 6, 13, 14, 15, 16, 17, 18, 24, 25	10
	MEDIUM	19, 20	2
Bankfontein 0/519	HIGH	27, 28, 29, 30, 35, 36, 37, 38, 39	9
	MEDIUM	-	0
Stock Port RE/283	HIGH	49, 50, 51, 52, 67, 68, 69, 70, 71,	9
	MEDIUM	58	1

The extent to which collision impact actually occurs with the turbines will need to be determined through rigorous pre and post construction bird monitoring. At the time of writing, independent pre-construction monitoring had begun on the site, and the first season's (spring) progress report was considered in this assessment. However, the report did not reveal any significant information to alter the findings of this study, and no firm conclusions regarding bird movement and behaviour on site can yet be made following only one season of monitoring. If significant mortalities are detected in post-construction monitoring, a range of mitigation options can be implemented. A site specific avifaunal EMP as well as a monitoring programme pre and post construction is seen as a critical next.

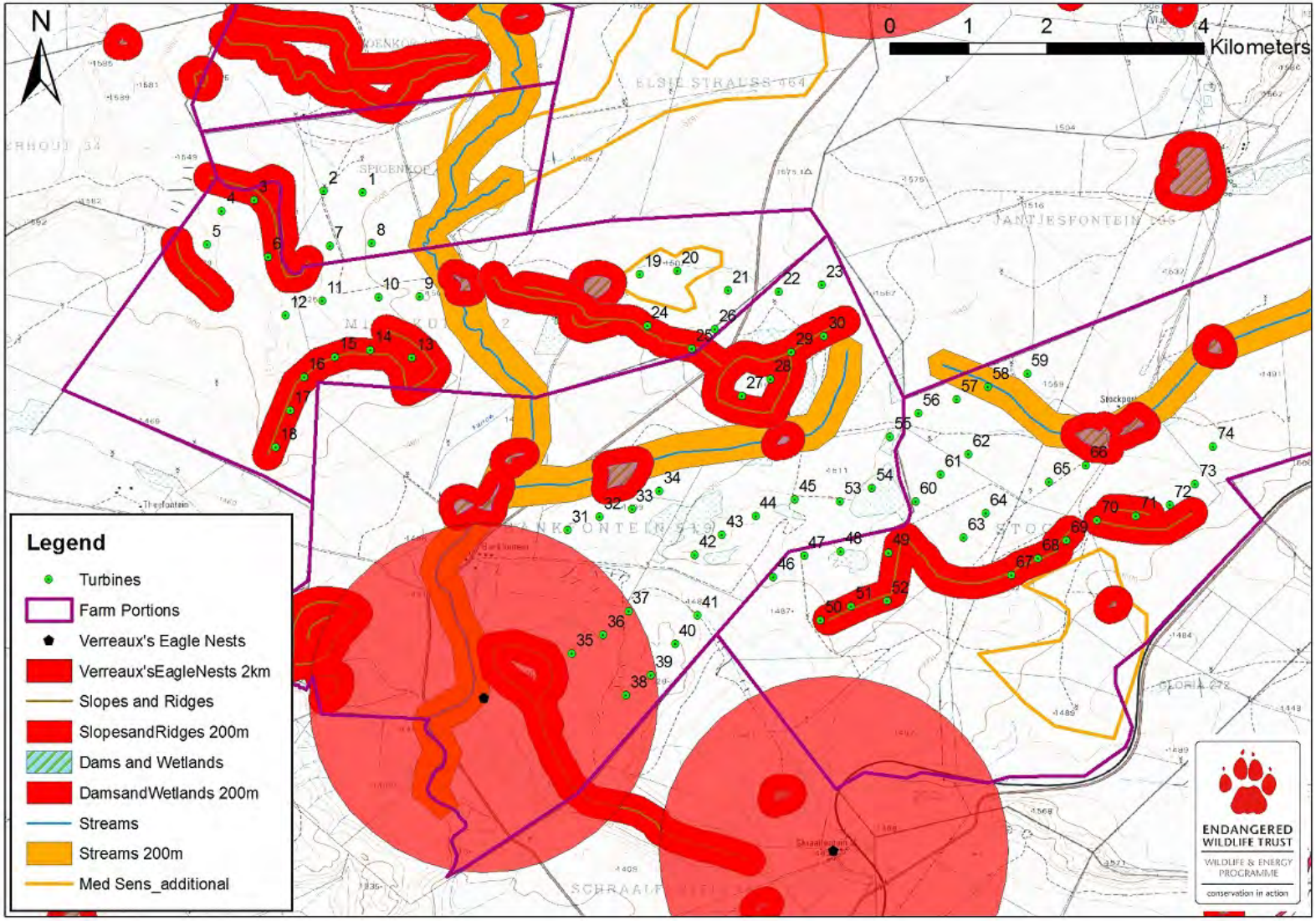

Figure 8.5: Avifaunal sensitivity zones for the Springfontein site

8.2.1 Bird Mortalities due to collisions with wind turbines

The three main hypotheses proposed for birds not seeing turbine blades are as follows (Hodos, 2002):

» An inability to divide attention between prey and obstacles. This seems an unlikely explanation as birds have been found to maintain good acuity in the peripheral vision, have different foveal region in the eye for frontal and ground vision and they have various other optical methods for keeping objects at different distances simultaneously in focus.
» The phenomenon of motion smear or retinal blur, explained earlier in this report.
» The angle of approach. If a bird approaches from side on to the turbine, the blades present a very small profile and are even more difficult to detect.

Impact Table - Bird Mortalities due to collisions with wind turbines

Nature: Collision of Birds with wind turbines		
	Without mitigation	With mitigation
Extent	(Local) (2)	(Local) (2)
Duration	(Medium) 5	(Medium) 5
Magnitude	(Moderate) 5	(Moderate) 5
Probability	(Definite) 5	(Probable) 3
Significance	**High (60)**	**Medium (36)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: The most important mitigation option with regards to collision is the correct positioning of turbines outside of the identified *high sensitivity* zones, and where possible, outside of the *medium sensitivity* zones. It is recommended that avifaunal pre and post construction monitoring is conducted using the BAWESG guidelines. Additional available or potential mitigation options therefore would need to be employed once the turbines are already operational, if monitoring reveals significant impacts. Some mitigation options that can be employed if monitoring reveals significant numbers of collisions, include: that one blade be painted black, in order to provide an alternating image for the bird in flight; curtailment, i.e. shutting down certain turbines at certain times; radar monitoring; manipulation of blade height to accommodate predominant bird flight height, and any others that may be identified as our understanding of the impacts progresses.		
Cumulative impacts: Compounding - The cumulative impact of bird collisions in the area is likely to be significant. Many of the target species for this study are species that are in all likelihood already significantly impacted upon by collisions with overhead cables in the area. An		

additional mortality factor such as collision with turbines may prove detrimental to local populations of these species.
Residual impacts: Medium

8.2.2 Displacement of Birds due to Disturbance

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 levelling 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 minimize 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. During the construction and maintenance of electrical infrastructure, a certain amount of disturbance also results. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding.

Impact Table - Impact on birds due to disturbance

Nature: Disturbance of Birds, particularly breeding species		
	Without mitigation	With mitigation
Extent	(Local) 2	(Local) 1
Duration	(Medium) 5	(Medium) 5
Magnitude	(Minor) 4	(Minor) 3
Probability	(Highly probable) 4	(Probable) 3
Significance	**(Medium) 44**	**(Low) 27**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: Mitigation for disturbance is the same as for habitat destruction. In general terms all construction activities should result in as little disturbance as possible. This will be detailed in the site specific EMP and will be enforced and overseen by the ECO for the project. During the EMP the avifaunal specialist must identify any breeding sensitive bird species in close proximity to specified turbines and associated infrastructure positions. Specific recommendations must be provided for each case and these must be strictly enforced and followed.		
Cumulative impacts: Medium		
Residual impacts: Medium		

8.2.3 Collision / Electrocution of Birds by Power line

» **Collisions** are one of the biggest single threats posed by overhead power lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, 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. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the result that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term.

» **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 electrocution risk of the proposed 132kV line can only be assessed once the tower structure to be used is known. Species that could be impacted upon include herons and some large eagles (non Red Data species).

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 levelling 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 Tables – Electrocution of birds with the Power line

Nature: Electrocution of Birds on the overhead power lines linking turbines and connecting the facility to the Eskom grid.		
	Without mitigation	With mitigation
Extent	(Local) 2	(Local) 1
Duration	(Medium) 5	(Medium) 5
Magnitude	(Moderate) 5	(Low) 4
Probability	(Probable) 3	(Improbable)

		2
Significance	**(Medium) 36**	**(Low) 20**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: A bird friendly mono-pole design, with bird perch (as per Eskom Guidelines) should be used in order to prevent electrocutions.		
Cumulative impacts: Compounding		
Re***sidual impacts***: Medium		

Impact Tables – Collision of birds with the Power line

Nature: Collision of Birds with new overhead power lines linking turbines and connecting the facility to the Eskom grid.		
	Without mitigation	With mitigation
Extent	(Local) 2	(Local) 1
Duration	(Medium) 5	(Medium) 5
Magnitude	(Moderate) 5	(Moderate) 5
Probability	(Highly Probable) 4	(Improbable) 2
Significance	**(Medium) 48**	**(Low) 22**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: Where possible, all new power lines should be placed underground. All sections of new line above ground will need to be marked with suitable bird flight diverters. Where possible, new lines should run adjacent to existing linear infrastructure such as roads and power lines. The length of new above ground line is to be kept to a minimum, and therefore grid connection via a new loop-in and loop out of the existing Besembos-Signal 132kV line on farm Stock Port RE/283 (as shown in figure 4 above) is preferred.		
Cumulative impacts: Compounding - The cumulative impact of bird collisions in the area is likely to be significant. Many of the target species for this study are species that are in all likelihood already significantly impacted upon by collisions with overhead cables in the area.		
Residual impacts: Medium		

8.2.4 Comparative Assessment of Alternatives

With regards to the associated infrastructure and grid connections the following recommendations are made:

» Laydown area (Preferred and Alternative)
Either are acceptable from an avifaunal perspective; however the Proposed Lay-down area is preferred.
» Temp Compound (Preferred and Alternative)
Either are acceptable from an avifaunal perspective, however the Proposed Temp Compound is preferred.
» OM Building and Substation (Proposed and Alternative).
There is no preferred option from an avifaunal perspective.
» Grid Connection Options
    * Loop-in and Loop out of the existing Besembos-Signal 132kV line is preferred.
    * Development of a new power line to the future planned Eskom Besembos substation is least preferred but acceptable.

8.2.5 Cumulative impacts

The cumulative impact of bird collisions in the area is likely to be significant. Many of the target species for this study are species that are in all likelihood already significantly impacted upon by collisions with overhead cables in the area. An additional mortality factor such as collision with turbines may prove detrimental to local populations of these species. There are existing power lines in the area, therefore addition of another power line will add to cumulative impacts on birds.

8.2.6 Conclusions and Recommendations – Avifauna

The proposed facility has the potential to significantly impact on avifauna in the area, although the EWT's confidence in this assessment is low, due to the lack of operation experience of commercial scale wind farms in South Africa and the absence of long-term monitoring data at this stage for this site. Although the site was found to be moderately to highly sensitive in terms of avifauna, there are no fatal flaws associated with the site (due to the low confidence with which impacts of wind turbines on South African bird species can be predicted), and the project should proceed subject to the mitigations, recommendations and conditions contained in the avifauna report.

In general the site is moderately to highly sensitive in terms of avifauna (with areas of high, medium and unknown sensitivity), based on:

» the occurrence of various listed species as well as numerous hovering and soaring raptors in the study area,

» the various micro-habitats (especially ridge lines) available to avifauna. Hills and ridges are important as they are likely to be used by numerous soaring and hovering raptors. Raptors often utilise high wind conditions to soar and hover along ridges, while looking downwards and hunting, which places them at risk of collision with turbine blades.
» on the site itself, the most important and prevalent micro habitats are farm dams, drainage lines, a non-perennial river and natural grassy shrublands, with the latter being the most extensive.

A number of focal or target species were identified through the field survey (and this data was supported by the sightings during the pre-construction monitoring programme), but of particular concern are Blue Crane, Blue Korhaan, Ludwig's Bustard, Secretarybird, Greater Flamingo and Verreaux's Eagle and Lesser Kestrel. Collision with the turbine blades is likely to be the most significant impact, to which all of the focal species are vulnerable. With a project of this size, habitat destruction may also be significant. Collision and/or electrocution on associated overhead powerlines, may also be significant, however these impacts could be drastically reduced if power lines could be constructed underground.

The following should be considered:
» The extent to which collision impact actually occurs with the turbines will need to be determined through rigorous pre and post construction monitoring as outlined in Jenkins *et al* (2011). Pre-construction monitoring is underway and should continue.
» If significant mortalities are detected in post-construction monitoring, a range of mitigation options can be implemented.
» A site specific avifaunal EMP as well as continuation and completion of the pre and post construction bird monitoring programme is seen as a critical increase our confidence, to refine the sensitivity map even further and to strengthen the mitigation measures in order to have the least impact possible on avifauna in the area. Details of the proposed operational phase bird monitoring methodology are contained in EMP.
» The layout of turbines should be informed by the sensitivity map and bird monitoring to assist with final placement of turbines.
» Layout options for the laydown area, temporary compound, substation site and the OM building are all acceptable from an avifaunal perspective, with the proposed sites being preferred to the alternative sites.
» In terms of the connection to the Eskom grid, the option of a Loop-in and Loop out of the existing Besembos-Signal 132kV line is preferred.
» In terms of the "no-go" alternative, the current status quo would be maintained by not implementing the proposed wind farm. The current farming activities will continue and the land use will not change. Presence and abundance of bird species, as described in the Avifaunal EIA

Report, would remain the same. Purely in terms of impacts on avifauna, this option would have the least impacts.

8.3 Assessment of Impacts on Bats

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

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

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.

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

The following micro habitats were identified during the site survey undertaken by the bat specialists and Google Earth satellite images were also used to assess the site. This data was supported by the bat monitoring programme which is currently underway for the Springfontein wind energy facility site:

» Drainage Lines: Drainage lines are characterised by slow flowing water and tall emergent vegetation. Insects such as midges and mosquitoes often breed at drainage lines emerging in

large numbers, creating a perfect feeding site for many bat species. Dams and reservoirs: Due to the standing nature of water in dams and reservoirs many insects use dams as breeding sites. The presence of these insects often attracts insect-eating bats. There are a number of active reservoirs on the site and a at least two large perennial dams.

» Thicket: Many of the bat species listed as possibly occurring on the site are clutter and clutter-edge feeders. The presence of thicket or bush on the site may increase the likelihood of such species being present and any alteration to this habitat may have negative effects on the presence of bats in the area, possibly even their survival.
» Man-made structures: Buildings are favoured by many bat species as safe, dry roost sites. They will often roost in the roofs of these structures. The farm houses, staff houses, abandoned structures and hunting lodges on the site all present suitable roosting habitat for many bat species.
» Cliffs, rocky outcrops and valleys: A number of bat species will roost in rocky outcrops and small caves. They are thought to use updrafts along cliff faces forage for insects and often feed in valleys where rivers are more likely to be found.

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

Based on historically recorded and modelled distributions by Friedmann and Daly 2004 and Monadjem *et al.* 2010 the number of bat species with the potential to occur in the study area numbers 14 species (See Table 8.4). Of the 14 species identified as potentially occurring in the study area one is Vulnerable, three Near threatened, nine Least Concern and one Data Deficient. Eight of the identified species are considered highly likely to occur in the study area (*Eidolon helvum, Minopterus natalensis, Rhinolophus swinnyi, Eptesicus hottentotus, Myotis tricolor, Neoromicia capensis, Rhinolophus clivosis* and *Tadarida aegyptiaca*), two considered moderately likely (*Cleotis percivalli* and *Rhinolophus denti*) and four are unlikely but possible to occur (*Rhinolophus swinnyi, Taphozous mauritianus, Nycteris thebaica* and *Rhinolophus darlingi*). Bat monitoring is being undertaken on the site.

Table 8.4 Potential bat species in the study area

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS	LIKELIHOOD OF OCCURRENCE
Cleotis percivali	Percival's Short-eared Trident Bat	Woodland	V	Moderate
Eidolon helvum	African Straw-coloured Fruit Bat	Fruit-producing woodlands	NT	High
Miniopterus natalensis	Natal Long-fingered Bat	Savanna/grassland	NT	High
Rhinolophus swinnyi	Swinney's horseshoe bat	Savanna/woodland	NT	Low
Rhinolophus clivosus	Goeffroy's horseshoe bat	Arid savanna/woodland	LC	High
Taphozous mauritianus	Mauritian Tomb Bat	Forest/savanna	LC	Low
Eptesicus hottentotus	Long-tailed Serotine	Rocky outcrops/caves	LC	High
Myotis tricolor	Temminck's Myotis	Savanna/mountains	LC	High
Neoromicia capensis	Cape Serotine	Wide tolerance	LC	High
Nycteris thebaica	Egyptian Slit-faced Bat	Savanna/karoo	LC	Low
Rhinolophus clivosus	Geoffroy's Horseshoe	Savanna/woodland	LC	High
Rhinolophus darlingi	Darling's Horseshoe Bat	Savanna/woodland	LC	Low
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Wide tolerance	LC	High
Rhinolophus denti	Dent's Horseshoe Bat	Rocky outcrops/caves	DD	Moderate

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

No habitats favourable for fruit bat species were found in or around the study site. It is unlikely that they would move into or occur in the study area, and are therefore unlikely to be at any risk as a result of this development. The bats species relevant to the site include:

» *Neoromicia capensis* was found throughout the greater area. This was expected because this species has a wide tolerance of habitat and is quite common throughout the region. This bat is a clutter edge forager and gives birth during the wet summer months. This species of bat roosts in houses, under the bark of trees and in mine shafts. It is likely that construction of the wind energy facility will affect any *N. capensis* roosts near to turbines and populations may be adversely affected through individual mortality during the operational phase.
» *Eptesicus hottentotus* was found in the area. This species occurs widely throughout the southern Free State and roosts in small groups of two to four individuals in caves or rocky crevices. No reproductive information is available for this species. It is likely that construction of

turbines close to the edge of rocky ridges will affect any *E. hottentotus* roosts and populations may be adversely affected through individual mortality during the operational phase.

» *Miniopterus natalensis* is listed as Vulnerable and is thus of conservation concern. This species is a clutter edge forager and gives birth in the wet season. The females congregate in maternity roosts. These areas would be critical to avoid during the project and it is likely that construction of turbines close to the edge of rocky ridges will affect *M. natalensis.* Populations may be adversely affected through individual mortality during the operational phase.
» *Tadarida aegyptiaca* is widespread and abundant throughout most of southern Africa. It roosts communally in small to medium-sized groups which may number in the dozens. They roost in buildings, caves and under the bark of trees. This species has been recorded foraging in a wide variety of habitats and does not appear to be constrained by particular vegetation types. Females give birth to their young in November or December and only once a year. It is likely that construction of the wind energy facility will affect any *T. aegyptica* roosts and populations may be adversely affected through individual mortality during the operational phase.
» *Rhinolophus clivosus* is widespread and fairly abundant in the eastern parts of South Africa and, though it does occur in the southern Free State it is mostly absent from the arid interior of the country. They roost in caves and often establish 'feeding stations' around insect-attracting house lights. This species is frequently associated with more rocky, elevated areas. Females give birth to their young in November or December and only once a year. It is likely that construction of turbines close to the edge of rocky ridges will affect *R. clivosus* roosts and populations may be adversely affected through individual mortality during the operational phase.

Areas on the site likely to support bat populations are highlighted in Figure 8.6 and are as follows:

» Areas of high sensitivity - 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 as having High Bat Sensitivity.
» Areas of moderate sensitivity - The areas assigned Moderate Bat Sensitivity include non-riparian slopes and smaller koppies. 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.

The bat specialist study recommended the following regarding the layout of the wind turbines:

» The following wind turbines occur in the High Bat Sensitivity zone - Turbines 25, 25, 27 and 28. 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 as having High Bat Sensitivity.

» The following wind turbines occur in the Moderate Bat Sensitivity – Turbine 36, 50, 51 and 67. – 72) The areas assigned Moderate Bat Sensitivity include non-riparian slopes and smaller koppies. These areas were designated based on their higher likelihood of supporting insects, and thereby attracting bats, and higher likelihood of providing suitable roost sites. These turbines should preferably be moved to alternative locations, but if this is not possible they must at least be prioritised in post-construction monitoring and implementation of mitigation measures.

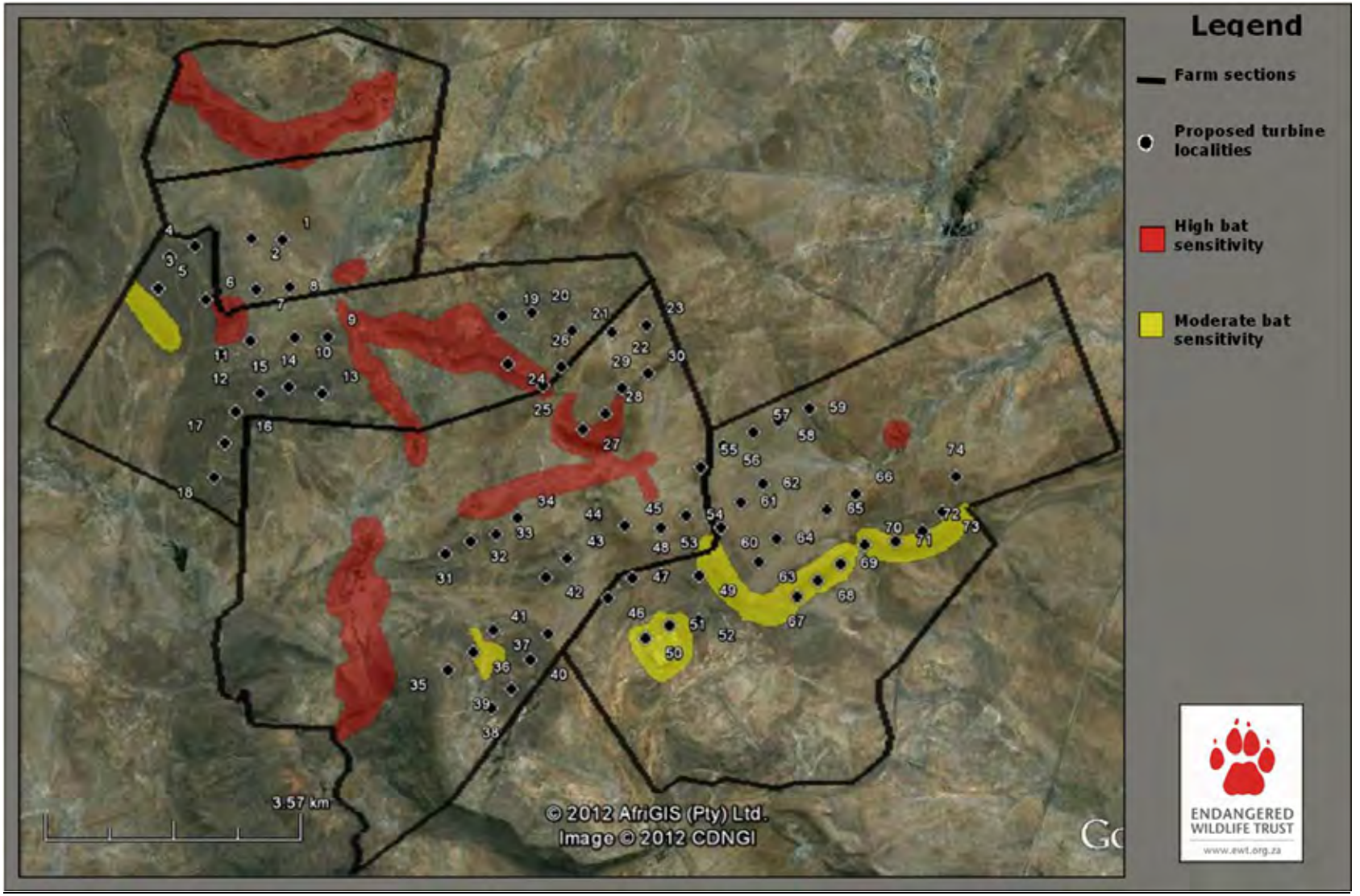

Figure 8.6: Areas of bat sensitivity on the Springfontein site

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

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

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

Impact Tables summarising impact on bats

Nature: Disturbance and/or destruction of bat roosts due to construction activities		
	Without mitigation	***With mitigation***
Extent	(Local) 2	(Local) 2
Duration	(Medium) 5	(Medium) 5
Magnitude	(Minor) 3	(Low) 2
Probability	(Highly probable) 4	(Improbable) 2
Significance	**Medium (40)**	**Low (16)**
Status	Negative	Neutral
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated	Yes	Yes
Mitigation: » A number of turbines have been proposed at locations very close to sites identified as potential roost sites, mainly along rocky ridges and outcrops. The correct placement of individual turbines can reduce the impacts on bats in the area. » The proposed turbine placements must be revised with the key objectives of moving the turbines located near potential roost sites (i.e. 25, 25, 27 and 28) to alternative localities. » The proposed placement of turbines 36, 50, 51 and 67 – 72 fall into areas of Moderate Bat Sensitivity and all close to potential roost sites. These should preferably be moved to alternative locations, but if this is not possible they must at least be prioritised in post-construction monitoring and implementation of mitigation measures. » If any bat roosts are discovered during any phase 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.
» Disturbance by pre-construction and construction activities at the turbine localities should still be kept to a minimum.

Cumulative impacts:

Compounding – the impact of two developments of a similar nature is likely to be more than twice the impact of two single developments. To reduce the possibility of impacting any bat roosts in the area it would be better to place a second development in a different area. Currently, there is no other wind energy facility proposed in this part of the Free State/ the Kopanong Local Municipality.

Residual impacts:

Medium – unless mitigated it is likely that the development will impact bat roosts in the area.

Nature: Bat fatalities due to collision or barotrauma while foraging

	Without mitigation	***With mitigation***
Extent	(Local) 3	(Local) 2
Duration	(Medium) 5	(Medium) 5
Magnitude	(Low) 4	(Minor) 3
Probability	(Definite) 5	(Highly Probable) 4
Significance	**High (60)**	**Medium (40)**
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:

» Deaths caused by wind turbines are well documented. Placing turbines in areas of high bat activity and between foraging or drinking areas that may be used as flight paths should be avoided. The correct placement of individual turbines can reduce the impacts on bats in the area.
» The proposed turbine placements must be critically revised with the key objectives of moving the Turbines located in areas of High Bat Sensitivity (i.e. 25, 25, 27 and 28) to alternative localities.
» Turbines located in the areas of Moderate Bat Sensitivity (36, 50, 51 and 67 – 72) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritized in post-construction monitoring and implementation of mitigation measures.
» Gaps of at least 250m should be left between turbines.
» The pre-construction monitoring programme should continue.
» In addition, informed curtailment programmes should be adopted where shown to be the only mechanism to prevent fatalities. Curtailment 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.

» Long-term post-construction/operational monitoring should be implemented to better inform such decisions.
Cumulative impacts: None
Residual impacts: Possible, however limited.

Nature: Bat fatalities due to collision or barotrauma during migration		
	Without mitigation	***With mitigation***
Extent	5	4
Duration	5	5
Magnitude	5	4
Probability	4	4
Significance	**High (60)**	**Medium (52)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	Possible loss of breeding success and population crash	Possible loss of breeding success and population crash
Can impacts be mitigated	Yes	Yes
Mitigation: » It has been shown that migrating bats are at higher risk of mortality through collision with turbine blades or barotrauma than non-migrating species. Little is understood about bat migration in South Africa but it is likely that bats migrate on nights of low wind speeds, temperate temperatures and no rain. Therefore, placing turbines in areas of high bat activity and between foraging or drinking areas that may be used as flight paths should be avoided. » Gaps of at least 250m should be left between turbines. In addition, informed curtailment programmes should be adopted. » The pre-construction monitoring programme should continue. » In addition, informed curtailment programmes should be adopted where shown to be the only mechanism to prevent fatalities. Curtailment 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. » Long-term post-construction/operational 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: Possible, however limited.		

Nature: Disturbance to and displacement from foraging habitat due to wind turbine construction and operation		
	Without mitigation	***With mitigation***
Extent	1	1

Duration	4	4
Magnitude	4	3
Probability	4	3
Significance	**Medium (36)**	**Low (24)**
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; however the use of lights can have a more permanent disturbance or attractive impact on bats. It is advisable that the lighting needs of the project are carefully considered and minimal lighting be used if possible. Low pressure sodium lamps are recommended, or UV filters should be fitted to other types of light. This will decrease the attraction of insects and thus to bat species. There should be no large scale lines of lights as these can act as barriers to bat movement.		
Cumulative impacts: None		
Residual impacts: Possible, however limited.		

8.3.1 Comparative Assessment of Alternatives

There is no evidence to suggest that bats are affected by power lines in any way. For this reason the alternative power line options were not assessed as part of this study. The location/ siting of the temporary construction camp, substation and other buildings are not of significance to impacts on bats, therefore no recommendation made.

8.3.2 Cumulative impacts

Cumulative impacts due to multiple wind turbines are assessed above. There are no other proposed wind energy facilities in this region on the Free State; therefor cumulative impacts will be limited to the facility itself and of low significance.

8.3.3 Conclusions and Recommendations

Any bat species that occurs in the vicinity of the site of the proposed Springfontein wind energy facility could be vulnerable to the potentially fatal impacts of wind turbines. At least one of the species identified as potentially occurring in the area of the study site is listed as Vulnerable (*Cleotis percivali*) and three as Near Threatened (*Eidolon helvum*, *Miniopterus natalensis* and

Rhinolophus swinnyi). Various areas throughout the study site were identified as potential roost sites and acoustic recording confirmed that at least one of the bats occurring in the areas is listed as Near Threatened (*Miniopterus natalensis*).

The overall impact of the development is likely to be of moderate to high significance if steps to mitigate impacts are not taken. Results from the pre-construction monitoring are required to more comprehensively assess the likely impacts and best ways to mitigate these. In addition, a operation phase monitoring programme would be required to be implemented to monitor the actual impact of the facility on local bat populations. The following mitigation is recommended at this time:

» The proposed turbine placements must be revised with the key objectives of moving the Turbines located in areas of High Bat Sensitivity (i.e. 25, 25, 27 and 28) to alternative localities to avoid the potential for bat collision with the wind turbines.
» Turbines located in the areas of Moderate Bat Sensitivity (36, 50, 51 and 67 – 72) should preferably be moved to alternative locations, but if this is not possible they must at least be prioritised in post-construction monitoring and implementation of mitigation measures.
» Gaps of at least 250m should be left between turbines.
» The pre-construction monitoring program is seen as critical in extending knowledge of wind energy and bat interactions. It is recommended that the monitoring program underway be continued. The programme must ensure that the data collected considers a host of environmental factors.
» Post-construction monitoring of bat fatalities during the operational phase is recommended for at least four seasons at the proposed wind energy facility.
» Plans for pre- and post-construction monitoring should consider the Sowler & Stoffberg (2012) guidelines in order to understand:
  o Seasonal and diurnal bat activity rhythms at the site.
  o The abundance of bat activity and which species are utilizing the site.
  o Site specific risks/ impacts to bats associated with the proposed the wind energy facility.
  o Effective mitigation and monitoring methods that will be appropriate for the wind energy facility.
» It is recommended that static monitors be placed on the meteorological mast as soon as possible so that pre-construction monitoring data can be gathered to better inform the construction and operational phases.
» Every effort should be made to mitigate the impacts on bats during this project through a construction EMP as well as by following the recommendations in this report.

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

8.4.1 Impact on the project on Land-use & Agricultural Potential

The farms upon which the Springfontein wind energy facility is planned are currently used exclusively for grazing with sheep, cattle and game, with sheep farming being the main enterprise. The land is currently stocked at between 11 ha/LSU and 13 ha/LSU. The agricultural potential of the site is moderate to low. Water for livestock consumption is extracted from boreholes dispersed over the properties. The average depth of the bore holes is 30m. There is also open water available from a perennial stream (fed by several fountains) and flowing through the farms Spioenkop, Ou Spioenkop, Mist Kuil and Bankfontein. This water source is also used for small scale irrigation with 2ha being irrigated on the farm Stock Port, 5ha on Bankfontein and 4ha on Spioenkop, Ou Spioenkop and Mistkuil. The irrigation lands are exclusively used for the production of lucerne and annual fodder crops for animal feed. The average annual rainfall for the region is 375mm (which is too low for dryland cropping). It is an unknown factor what the influence of the wind turbines will be on the rainfall of the site. Apart from a few weirs and erosion control dams, there are no important agricultural infrastructure (i.e. silos, irrigation lines, pivot points, channels and feeding structures, etc.) or conservation works (i.e. contour banks, waterways, etc.) that will be interfered with.

Agricultural resources that may be impacted upon include:

» Soils and watercourses (degradation due to wind and water erosion, as well as by contamination with oil, petrol, diesel and other contaminants used by the construction vehicles and equipment)
» Vegetation and grazing capacity (degradation due to a decrease in species composition, vegetation cover and a loss of grazing capacity)
» Underground water (degradation due to contamination by oil, petrol, diesel and other contaminants used by the construction vehicles and equipment)
» Livestock production systems (interference with farm and livestock management activities and a decline in the long term food production)

Agricultural sensitive areas or areas of high agricultural value include a watercourse which runs through the farms Spioenkop, Ou Spioenkop, Mistkuil and Bankfontein (illustrated in Figure 8.2 – The ecological sensitivity map for the site (Section 8.1). The watercourse and drainage lines are ecologically sensitive and should be considered as sensitive areas.

Impact Table – Land Use and Agricultural Potential

Nature of Impact: Loss of land with high agricultural potential and land capability due to the development of the wind energy facility		
	Without mitigation	***With mitigation***
Extent	Low (1) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance*	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but indirect impacts can be minimised and avoided through adequate planning of layout	
Mitigation: None.		
Cumulative impacts: Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures should be implemented.		
Residual Impacts: The loss of agricultural land is a long term loss, however limited an arid are of low agricultural potential and to the footprint of the wind turbine and infrastructure will occupy a minimal percentage of the land, and that agriculture can still continue on the rest of the farm (not occupied by infrastructure for the facility). This loss extends to the post-construction phase albeit of a low to negligible significance.		

8.4.2 Soil Erosion / Degradation during Construction

The following soil forms (as per the MacVicar et al 1991 classification) were identified on the site during the verification process, i.e. Swartland, Valsrivier, Oakleaf, Arcadia, Rensburg, Glenrosa and Mispah. These soils are shown in Figure 8.7. Only the Rensbugr soil type is of concern.

Based on the attributes of the soils assessed, the following is concluded:

» The soils present on the site have high clay percentages, primarily in the B-horizon. This makes the soils less suitable for cropping, especially dryland cropping. The site's best land use capability is therefore primarily for veld and grazing, with limited potential for irrigation.
» The soil forms (The Rensburg soil-form) that occur on the site are sensitive to water erosion when disturbed and denuded of vegetation. Special care should

therefore be taken during the construction phase to minimise water erosion on the construction sites and road surfaces.

The Rensburg soil-form (for which an Rb label is used on the map) consists of a vertic A-horizon over a G horizon. It is a deep soil of between 800mm and 1000mm, with a very clayey texture and a clay content of more than 50%. Rensburg soils are highly plastic and extremely physically active and shrink when dry and swell when wet. They occur in the drainage lines and the non-perennial river on the site. The areas where they occur are therefore considered as no-go areas for the placement of wind turbines and underground cabling. Based on the current layout, no wind turbines or infrastructure are proposed on this soil type.

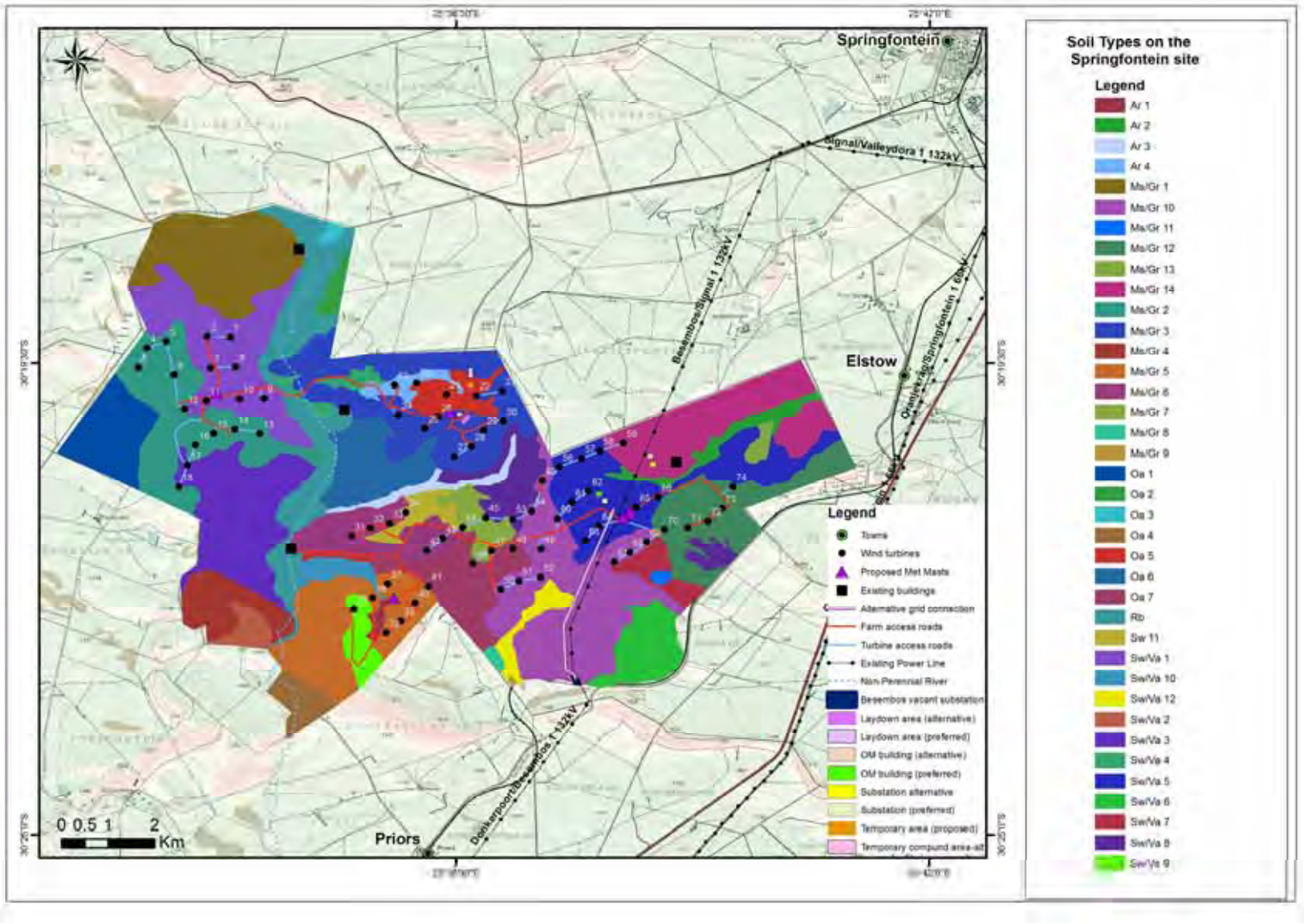

Figure 8.7: Soil Types of the Springfontein site development footprint

There are several watercourses present on the site (refer to Figure 8.2). Watercourses are sensitive to water erosion if disturbed and are considered as 'no-go-areas for the placement of wind turbines and underground cabling. There are two wind turbines planned on one of the indicated watercourses on the farm Mistkuil (wind turbines numbers 19 and 20). Care should be taken during the final placement of the wind turbines to avoid construction activities in these watercourses, including the placement of roads. The cultivated land (11ha) and old cultivated lands on the site are situated within the watercourse areas and they would not be impacted upon by the development of the wind farm as long as the footprint of the development is placed outside of the watercourse areas.

The slopes on the site vary between gently sloping to steep. The larger area of the site is moderately sloping (less than an 8% slope). The steeper slopes on the site are indicated in Figure 8.8. No wind turbines are placed on slopes greater than 20%.

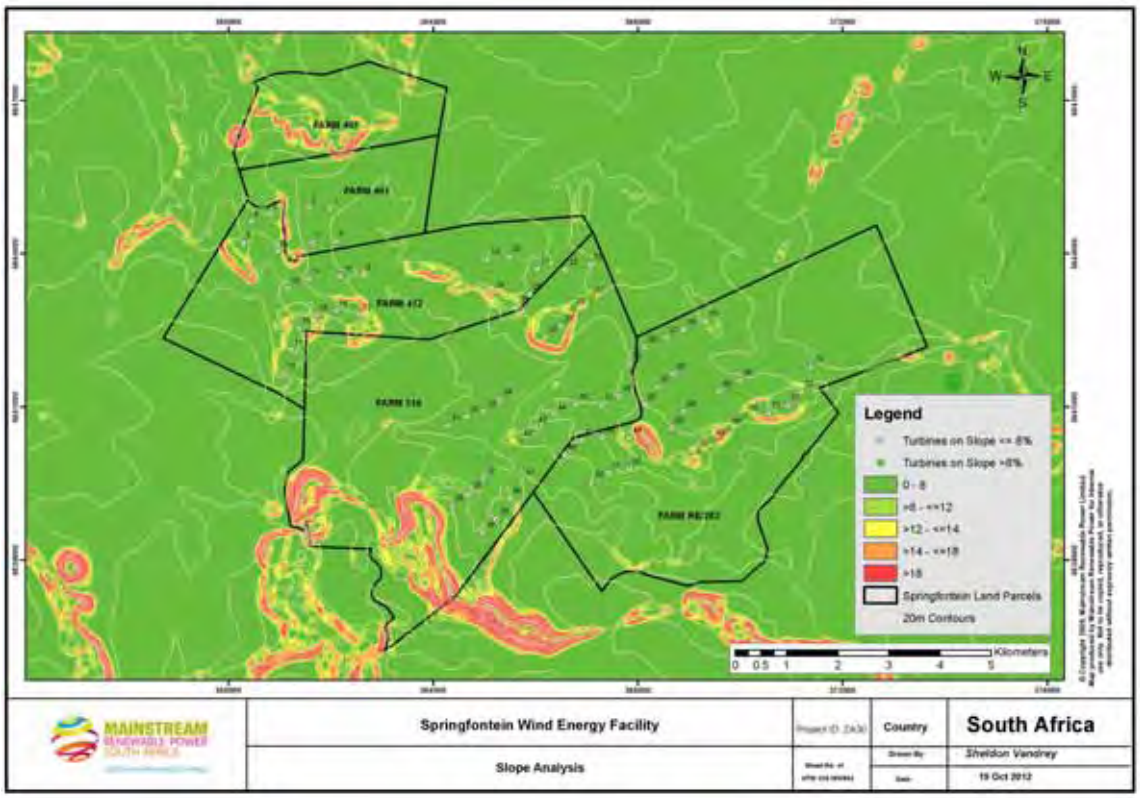

Figure 8.8: Slope map for the Springfontein site development footprint

Activities / infrastructure that may have an impact on soils include:

» Wind turbines (i.e. construction and positioning of the concrete foundations of the wind turbines, positioning and construction of underground cabling

between the wind turbines, construction and positioning of an on-site substation, construction and positioning of a workshop, office, maintenance and storage area)
» Construction and positioning of internal access roads
» Construction and positioning of the overhead power line/s
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)

Impact Table – Soil erosion / degradation during construction

a) 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	Regional (3)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**High (80)**	**Low (1)5**
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 using indigenous grasses such as *Digitaria eriantha, Eragrostis curvula*, etc.
- Restrict size of authorised disturbance areas.
- Minimise activity on steep slopes / the side of slopes.
- Implement effective erosion control measures.
- Keep to existing roads, where practical, to minimise impact on undisturbed ground.
- Ensure stable slopes of stockpiles/excavations to minimise slumping.
- Stockpiles should not exceed 2m in height unless otherwise permitted by the Engineer.
- Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion, only if natural seeding does not occur.

Cumulative Impacts:

The cumulative impact of soil erosion from all development in the area is considered low if mitigating measures are adhered to.

Residual Impacts:

Minor – Localised movement of sediment. Slow regeneration of soil processes

8.4.3 Soil Contamination / Soil Erosion during the Operation of the facility

During the maintenance activities (operations) of the site, the possibility for soil contamination exists in the event of spillage of oils, fuels or hydrocarbons used for maintenance of the wind turbines, substation or power line. In addition, spillage of fuels from vehicles may occur. These impacts on soil can be mitigated to a low significance.

Impact Table – Soil Contamination / Soil Erosion during the Operation of the facility

Nature: Increased pollution of soil by contaminants (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation:	» Control use and disposal of potential contaminants or hazardous materials. » Remove contaminants and contaminated topsoil and replace topsoil in affected areas. » Implement measures to avoid /reduce chemical spillages during the operation of the facility (such as spill kits).	
Cumulative impacts:	» The cumulative impact of soil pollution is considered low due to the undeveloped nature of the study area.	
Residual impacts:	» Minor negative – slow regeneration of soil processes in and under topsoil	

8.4.4 Cumulative impacts

The development of the project does have the potential to have negative cumulative impacts on soil. Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures must be

implemented. With good soil management, cumulative impacts can be prevented.

8.4.5 Comparative Assessment of Alternatives

The soil types and the steep erosion sensitive slopes are similar for both substation options. There are no major differences in the significance of impacts for either of the proposed substation alternatives in terms of impacts of soils or geology.

The location of the preferred and alternative O& M building are in acceptable locations from a soils perspective. The locations of the preferred and alternative construction laydown area are in acceptable locations from a soils perspective. The locations of the preferred and alternative temporary construction compound are in acceptable locations from a soils perspective.

8.4.6 Conclusions and Recommendations

» The long term impact on the agricultural production and food security by the proposed Springfontein Wind Energy Facility will be small/ insignificant as long as the development adheres to the environmental management that has been developed. The development of the site as a wind energy facility will only have a short term negative impact on the production of agricultural products from the property. That is during the construction phase of the project when the construction activities may interfere with the normal management practices on the property. Thereafter, the livestock and game farming activities will return to normal and the presence of the wind turbines is not expected to have any negative effect on normal farming and management practices.
» The soils on the site are susceptible to water erosion and the undulating nature of the site could contribute to this. Special measures should therefore be adopted during the construction of infrastructure (i.e. roads, buildings, wind turbine foundations, internal cabling between turbines, etc.) to keep water erosion to a minimum and to be adopted in the EMP. Uncontrolled soil erosion will directly influence the soil and vegetation where the erosion takes place and will also have a cumulative impact on watercourses on the site, as well as downstream from the site.
» There are drainage lines and a non-perrenial river on the site. These watercourses are susceptible to water erosion. A few of them are already degraded and show signs of donga erosion. All the watercourses on the site should be regarded as no-go areas for the placement of wind turbines and underground cabling. There are two wind turbines planned on one of the

indicated watercourses on the Farm Mistkuil (wind turbines numbers 19 and 20), which should be repositioned.

» The slopes on the site vary from level to steep. There are a few steep slopes on the site that should be regarded as no-go areas in terms of the placement of wind turbines and internal cabling between turbines. Due diligence should be observed in terms of stormwater management from internal roads, specifically on roads on steeper slopes.
» There are in total 11ha of irrigated lands on the site, which are primarily used for the production of fodder for livestock. They are all located in or near the watercourses on the site. As long as the drainage lines and the non-perennial river are regarded as no-go areas, the development on the site will not impact on these lands.
» Apart from a few weirs and several erosion control dams (in the watercourses) there is no agricultural infrastructure (i.e. silos, irrigation lines, pivot points, channels, feeding structures, grazing camps, animal housing, farm roads, etc.) or any conservation works (i.e. contour banks, waterways, etc.) on the site. As long as the drainage lines and the non-perennial river are regarded as no-go areas, the development on the site will not impact on these lands.

8.5 Assessment of Potential Social and/ Economic Impacts

Social impacts associated with the project will occur during the construction and operational phases. Both positive and negative social impacts are discussed below.

8.5.1 Construction - Creation of Employment and Business Opportunities and Opportunity for Skills Development

Based on the information provided by Mainstream, the capital expenditure associated with the construction of the project would be in the region of R1.6 billion (2012 Rands). The construction phase is expected to extend over a period of ~18 months and create approximately 265 construction related jobs. Of this total approximately 41% (109) will be available to skilled and professional personnel (engineers, technicians, management and supervisory), ~20% (52) to semi-skilled personnel (drivers, equipment operators), and ~39% (104) 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 the closest towns, namely Springfield, Trompsburg, Bethulie and Philippolis. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch

of skills and low education levels, the potential employment opportunities for the members from these local communities may be low.

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 a wind energy facility the opportunities for the local economy are likely to be limited. However, opportunities are likely to exist for local contractors and engineering companies in Bloemfontein.

The majority of construction workers are likely to be accommodated in the local towns, namely Springfield, Trompsburg, Bethulie and Philippolis. This will create opportunities for local hotels, B&Bs, guest farms and people who want to rent out their houses. However, based on the information collected during the site visit accommodation opportunities in these towns is likely to be limited. This is an issue that the proponent will need to discuss with the Kopanong Local Municipality.

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 benefits to the local economy will be confined to the construction period (18 months). 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.

Impact Table - Creation of Employment and Business Opportunities during the Construction Phase

***Nature*:** Creation of local employment and business opportunities during the construction phase associated with the wind energy facility.		
	Without Mitigation	**With Enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local communities and businesses)	Local – Regional (3) (Rated as 3 due to potential opportunities for local communities and businesses)

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	

Mitigation:

» Where feasible, 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.
» Before the construction phase commences the proponent should meet with representatives from the Local Municipality to establish what skills exist in the area and develop a database.
» 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.
» The proponent, in consultation with the Local Municipality, should develop a database of local companies, specifically companies that qualify as Black Economic Empowerment (BEE) companies that qualify as potential service providers prior to the commencement of the tender process for construction contractors.

Cumulative impacts: Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities and limited skills range, this benefit is likely to be limited.

Residual impacts: Improved pool of skills and experience in the local area. However, due to relatively small number of local employment and skills-transfer opportunities this benefit is likely to be limited.

8.5.2 Presence of construction workers in the area

The presence of construction workers poses a potential risk to family structures and social networks in the area, specifically local farm workers in the area and communities in the local towns in the area. 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.

The findings of the SIA indicate that the local farmers in the area are strongly opposed to construction workers being accommodated on the site. The option of accommodating workers on site has been considered by the proponent. However, based on experience from other projects this option is not recommended. In addition, a number of local farmers have indicated that they are opposed to the accommodation of construction personnel on the site, with the exception of security personnel. Note that the temporary construction camp will house between 8-10 employees (security personal).

While the potential threat posed by construction workers to the community as a whole is likely to be low, the impact on individual members who are affected by the behavior of construction workers has the potential to be high, specifically if they are affected by STDs etc.

Impact Table – impact of the presence of construction workers in the area on local communities

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium (3)	Medium (3)
Magnitude	Low for the community as a whole (4)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)**	**Low for the community as a whole (24)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

» 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 and the contractor should develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South

African labour legislation; » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; » The movement of construction workers on and off the site, specifically construction workers from outside the area, should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting non-local workers to and from site on a daily basis; » The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by construction workers from outside the area on local family structures and social networks; » It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.
***Cumulative impacts*:** Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.
Residual impacts: None

8.5.3 Construction - Risk of stock theft, poaching and damage to farm infrastructure

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, except over the Christmas-New Year period. The directly affected landowners also indicated that they would be able to reduce the potential risk to their livestock by moving them other parts of the farm during the construction phase. In addition, as indicated above, a number of the farmers have indicated that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

Impact Table – Stock theft and damage to farm infrastructure

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	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 proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences; • The proponent should consider developing a Code of Conduct for construction workers. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; • The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below); • The EMP will outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; • The housing of construction workers on the site should be limited to security personnel.		
***Cumulative impacts*:** None**,** provided losses are compensated for.		
Residual impacts*:* None		

8.5.4 Increased risk of fires during construction

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 potential risk of veld fires is heightened by windy conditions in the area, specifically during the dry, windy winter months;
» The dominant agricultural activity in the broader area is stock farming (sheep and goats). As such, the livelihoods of the farmers in the area are dependent on grazing on their farms. Any loss of grazing due to a fire would therefore impact negatively on the affected farmers livelihoods;
» The risk of fire related damage is exacerbated by the limited access to fire-fighting vehicles.

The owners of two of the adjacent farms, Mr Louw (De Poort) and Mr Gatham (Farm RE/105) both noted that veld fires in the area posed a risk to farming activities. Both landowners raised the issue of compensation for damage and costs associated with fires linked to the construction phase of the proposed wind energy facility. The recommended mitigation measures are listed below.

Impact Table – Increased risk of fires

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: » The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase		

commences. » Contractor to ensure that open fires on the site for cooking or heating are not allowed except in designated areas. » Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months. » Contractor to provide adequate fire fighting equipment on-site. » Contractor to provide fire-fighting training to selected construction staff. » 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. » Use of fire prevention and fire management strategies for the wind energy facility. » The landowners and developer should ensure that they join the local fire protection agency.
Cumulative impacts: None, provided losses are compensated for.
Residual impacts: None

8.5.5 Impact due to increase in traffic during construction

Based on the information from the proponent the majority of the components associated with the proposed wind energy facility are likely to be transported to the site by road from Port Elizabeth via the N10, N9 and N1, which links Port Elizabeth in the south with Bloemfontein in the north. The movement of large, heavy loads during the construction phase has the potential to create delays and safety impacts for other road users travelling along the N10, N9 and N1. These impacts can however be mitigated by timing the trips 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.

Several abnormal loads using large trucks will be associated with the construction phase. In addition, crawler cranes (~ 750 t) and assembly cranes may also need to be transported onto and off the site. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc. If required, Mainstream will consider the upgrade of the farm gravel roads to the site for the transportation of the wind turbine components during construction. Mainstream will have to apply for a permit to transport abnormal loads on public roads. In order to avoid traffic congestion and road safety during construction, various mitigation measures and road safety measures can be used.

The findings of the SIA indicate that the volume of traffic on the local roads that link the site to Springfontein is low. The social impacts associated with the movement of construction related traffic along these roads are therefore likely to be low.

Impact Table – Increase in traffic during construction

Nature: Traffic congestion and associated noise, dust and safety impacts associated with movement of construction related traffic to and from the site on road / private roads.		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
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:

» The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. This should include includes damage to local roads and internal farm roads. The agreement should be signed before the construction phase commences;

» The proponent and contactor should meet with the local farmers to identify the best time of the day to transport heavy machinery on to the site so as to minimise potential disturbances to other road users;

» The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair should be borne by the proponent;

» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers;

» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts:

If damage to roads is not repaired then this will impact on the farming activities in the area and also result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.

Residual impacts:

None

8.5.6 Damage to and loss of farmland during construction

The activities associated with the construction phase have the potential to result in the loss of land available for grazing. However, the affected farm owners indicated that the project would not impact on current farming activities. In addition, the affected landowners have entered into lease agreements with the proponent. The loss of productive farmland would therefore be offset by the income from the lease agreement.

The final disturbance footprint can also be reduced by careful site design and placement of components. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. Recommended mitigation measures are outlined below.

The landowner is compensated for leasing of the land by Mainstream. Where properly planned, the final footprint of disturbance associated with a wind energy facility is small and is linked to the foundation of the individual wind turbines, services roads, substations and power line. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase and that construction is limited to the area for the facility, so that farming activities may continue on areas that are not utilised by the wind energy facility. The impact can be reversed, as once construction is complete farming activities may resume on the site.

Impact Table – Damage to and loss of farmland during construction

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines 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 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: None		

8.5.7 Operational Phase -Creation of Long- Term employment and business opportunities

Based on information provided by Mainstream, the establishment of the Springfontein wind energy facility will create ~17 permanent employment opportunities. The operational phase is expected to last 20 years. Of this total, ~4 will be available to skilled personnel and 13 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. The potential benefits for the local community will therefore be limited given the relatively low number of permanent employment opportunities.

Given the location of the proposed facility the majority of permanent staff is likely to reside in the nearest local towns, namely Springfontein, Trompsburg, Bethulie and Philippolis. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in one of these towns, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the operational lifespan of the project.

The local hospitality industry in the area is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations. The establishment of a Community Trust, as required in terms of the Request for Proposal Document prepared by the Department of Energy, will also create potential benefits for the local community.

Impact Table – Creation of Long- Term employment and business opportunities

Nature: Creation of long-term employment and business opportunities associated with the operational phase		
	Without Mitigation	***With Enhancement***
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (21)**	**Medium (32)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The establishment of a Community Trust should be discussed with the Local Municipality. » The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project.		
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members		

from the local community and creation of additional business and economic opportunities in the area. Creation of revenue stream to fund local projects, thereby enhancing local economic and social development in the area.
Residual impacts: None

8.5.8 Benefits associated with the establishment 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.

A Community trust provides an opportunity to generate a reliable and steady revenue stream over a 20 -25 year operational lifespan of the wind energy facility. This revenue can be used to fund development initiatives in the area and support local economic and community development. The 20 year timeframe also allows local municipalities and communities to undertake long term planning for the area. Based on the information provided by Mainstream the revenue from the proposed wind energy facility will be used to support a number of social and economic initiatives in the area, including:

» Land Reform;
» Enterprise Development;
» Energy;
» Education; and
» Healthcare.

Impact Table Summarising impacts of establishment of a community trust

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development		
	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: See below		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: None		

8.5.9 Development of Renewable Energy Infrastructure

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively moderate. However, the 85-100 MW produced will help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

Impact Table – Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa

Nature: Development of renewable energy infrastructure in Free State, South Africa.		
	Without Mitigation	**With Mitigation** (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)

Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement: See below		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: None		

8.5.10Potential Impact of the wind energy facility on tourism in the region

The FSPGDS identifies tourism as one of the key economic drivers in the Province. However, the focus appears to be on promoting tourism in the north east of the Province. Despite this caution must be taken to ensure that the development of renewable energy projects, such as the proposed solar energy facility, do not affect the tourism potential of the Province. However, based on the findings of the site visit, the proposed facility is not likely to impact on the tourism sector in the area or the Province. This is due to the sites location and the existence of existing infrastructure in the area, including the railway line, power lines and the proposed Besembos Substation site. The significance of this issue is therefore rated as low negative. In some instances the wind energy facility may also attract tourists to the area. However, the significance of this potential benefit is also rated as low positive.

The VIA also states that tourism to this region is limited, as there are no major attractions in this area. However, there are limited numbers of hunters who visit this area during the winter hunting season, as well as travellers who use the guesthouses in the area as overnight stops between Gauteng and Western Cape. Travellers do not necessarily come to the area for the scenic quality, but rather to overnight while travelling to another destination (Aurecon, October 2012).

Impact on tourism industry

Nature: Potential impact of the wind energy facility on local tourism		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24) (Applies to both – and +)**	**Low (27) (Applies to both – and +)**
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent should liaise with representatives from the KLM 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 KLM		
Residual impacts: None		

8.5.11Potential Health Impacts due to the Operation of the wind energy facility

The potential health impacts typically associated wind energy facilities include, noise (discussed as a separate impact in this report), shadow flicker and electromagnetic radiation. The findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The

research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation (WHO, 2004).

Based on these findings it is assumed that the significance of the potential health risks posed by the proposed wind energy facility is of low significance. The potential noise impacts are covered in the specialist Noise Impact Assessment.

8.5.12Comparative Assessment of Alternatives

The proposed grid connection (loop-in looped) out line is preferred, due to limited visual impact and disturbance during construction. No specific preference on the preferred and alternative location of the construction compound and office made.

8.5.13Cumulative Social Impacts

The cumulative impacts associated with wind energy facilities, such as the proposed Springfontein wind energy facility, are largely linked to the visual impact on the areas sense of place and landscape character.

The proposed Springfontein wind energy facility and establishment of the other renewable energy projects in the area also have the potential to result in positive cumulative socio-economic impacts for the Kopanong Local Municipality (KLM). The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase) and creation of downstream business opportunities. The significance of this impact is rated as High positive with enhancement.

8.5.14Conclusions and Recommendations

The development of the proposed Springfontein wind energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the Kopanong Local Municipality, which, in turn, will result in a positive social benefit.

The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed wind energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility this will represent a significant social benefit for an area where there are limited opportunities.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Springfontein wind energy facility is therefore suitable.

8.6 Assessment of Potential Visual Impacts

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created.

The region, being used for extensive grazing, is sparely populated and viewer numbers are therefore limited. In general, farm homesteads are situated 5 – 10 km apart. Settlements in the study area are small and widely dispersed. The majority of the viewers are likely to be to the east of the site since Springfontein, the closest town, is located approximately 10 km northeast of the closest proposed turbine (turbine 74). The next closest town, Philippolis, lies approximately 27 km west of the proposed wind energy facility would not be visually affected by the wind energy facility due to distance and intervening topography.

The main source of viewers in this area would be the N1 highway, the main road between the Western Cape and Gauteng and Bloemfontein in the north. The N1 is located to the east of the site and motorists along this road would form the majority of the viewers of the proposed wind energy facility. The distance from the N1 to the closest proposed turbine would be approximately 2.7 km and 14 km to the furthest proposed turbine. Views of the proposed wind energy facility from the N1 are a concern for the Free State Planning Department of Co-operative Governance and Traditional Affairs. They have accordingly requested that the turbines should be placed as far as possible from the N1.

Tourism to this region is limited, as there are no major attractions in this area. However, there are limited numbers of hunters who visit this area during the winter hunting season, as well as travellers who use the guesthouses in the area as overnight stops between Gauteng and Western Cape. Travellers do not necessarily come to the area for the scenic quality, but rather to overnight while travelling to another destination.

The expectation of viewers is important: an expectation of a superlative visual quality that is impaired by a development results in a higher significance of visual impact than when a landscape is expected to be of moderate or low visual quality. An analogy can be made to people going on holiday and looking forward to

reaching their destination, where they hope to experience uninterrupted views of the sea, for instance. Placing a wind turbine in their field of view at the sea would result in a far higher sense of visual "disharmony" than placing the same wind turbine somewhere along the road in an area where they do not expect to experience a valued view.

In summary, the following group of viewers/receptors have a possibility of viewing the proposed wind energy facility:

» Motorists who travel on the N1 and overnight in the area;
» Residents of Springfontein;
» Residents of farms in and around the site; and
» Occasional visitors such as hunters.

Owners of the farms on which the wind turbines are proposed to be placed are understandably positive towards the proposal because they could gain financially from the project. Other people such as neighbours and people who move through the study area may be more negatively inclined towards the project. However, perceptions are unlikely to be highly negative, since there are no well-known scenic resources within the immediate vicinity of the proposed wind energy facility. The greatest portion of the study area is covered by grassland (high visual quality), shrubland (high visual quality) and bare rock and soil (high visual quality), which rates the area generally to have a high visual quality rating.

8.6.1 Visibility (Viewshed)

The viewshed (shown in Figure 8.7), which has been generated by generation of a Digital Terrain Model in a GIS platform during the scoping phase indicates the area from which a wind turbine with a total effective height of 120 m would theoretically be visible. For this analysis, a viewshed was generated for each individual wind turbine and the resultant 74 viewshed were combined to produce a composite viewshed that represents the cumulative impact of all 74 turbines. The viewshed indicates that the tops of the wind turbines may theoretically be visible from as far as 30 km (e.g. from Gariep Dam and Philippolis), as there will be direct line of sight from these points. However, due to the advanced distance, in practice the turbines would not be visible over such long distances.

8.6.2 Visual Exposure

The visual exposure or viewer proximity of the proposed project is based on distance from the proposed source of impact. The visibility of an object decreases exponentially over distance and accordingly visual impact will diminish as the viewer moves away from the object being viewed. The highest visual exposure,

due to the project's shape and size, would be within a radius of 3km from the site.

Visual exposure is expressed as follows:

» High (0-1km) – dominant or clearly visible
» Moderate (1-3km) – recognisable to the viewer
» Low (3-5km) – not particularly noticeable to the viewer

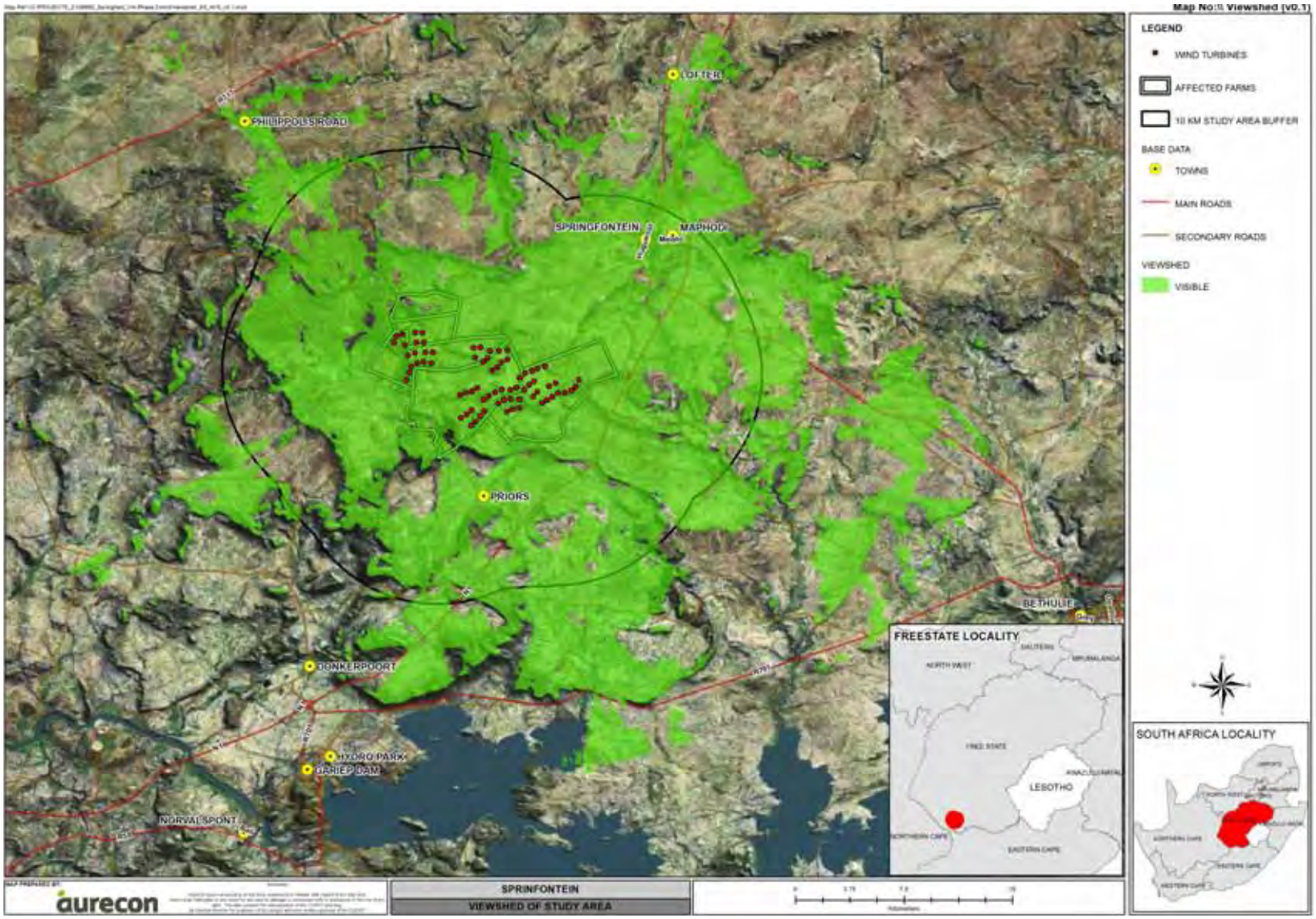

Figure 8.7: Viewshed Analysis of the proposed Springfontein Wind Energy Facility (the black line shows a distance of the 10km)

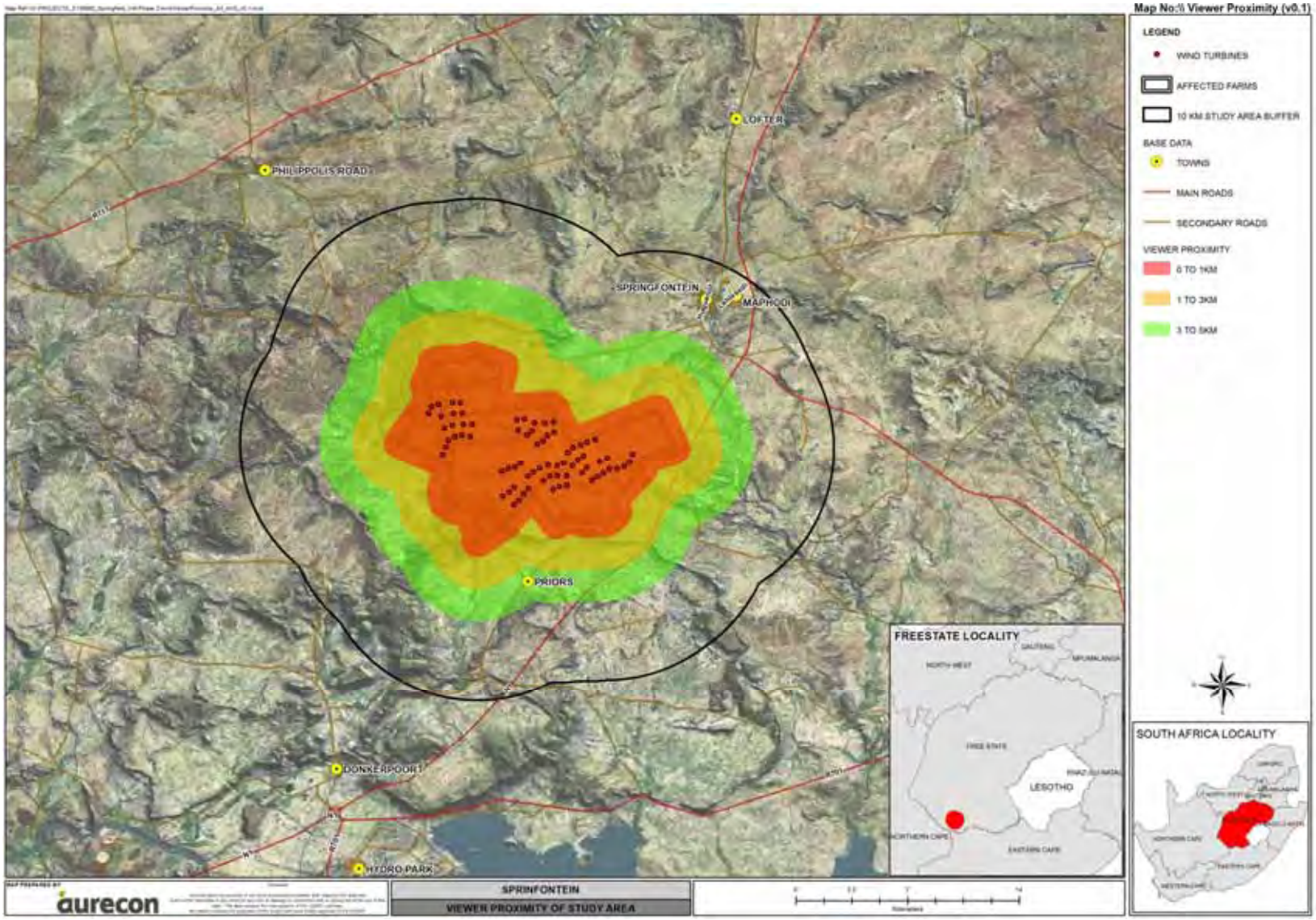

Figure 8.8: Viewer Exposure for the Springfontein Wind Energy Facility

8.6.3 Viewer Sensitivity

Viewer sensitivity refers to people's sensitivity to a potentially discordant visual element in the landscape. This depends on the number of people viewing the project and their perceptions of the study area. Perception of an object is linked to the purpose for which a viewer is present in the study area (i.e. the reason for their visit). Thus, a visitor to the study area that comes to see undisturbed natural landscapes such as a conservation area would be more sensitive to a development than someone visiting an industrial zone for business purposes. The sensitivity of a particular individual to the visual impact of a proposed development may, therefore, also vary over time as they experience different features and land uses in the area.

Viewer Sensitivity is therefore expressed as follows:

» High – e.g. nature reserves, coastal areas and scenic routes or trails;
» Moderate – e.g. residential areas, agricultural areas, sporting / recreational areas or places of work; and
» Low sensitivity – e.g. industrial, mining or degraded areas (not applicable in this instance).

In this study area, the only nature reserve is the Gariep Dam Nature reserve in the southernmost section of the study area. Although this has been mapped as an area of high viewer sensitivity, it is unlikely (due to the long distance) that any of the turbines would be visible from this nature reserve. A visual receptor's sensitivity is based upon the viewer's:

» Familiarity with the actual scene;
» Circumstances that brings them into contact with that view; and
» Nature of the view (full or glimpsed, near or distant).

Tourists and people participating in local recreation and residents will most probably indicate a moderate sensitivity and farmers and people travelling on the adjacent roads will indicate a moderate sensitivity towards the proposed development. Viewer sensitivity and viewer numbers are directly proportional and will thus decrease on secondary roads.

8.6.4 Critical Viewpoints

Principal viewpoints were selected based on traffic volumes (major routes), higher population densities and potential sensitive areas. These areas are considered as critical view zones with the probability of the most significant visual impacts. The panoramic photos below provide a general overview of the appearance of the study area.

The N1 is the most important corridor along which viewers will move through the area and to a lesser extent the other secondary and minor roads in the area. As a result of the southwest-northeast orientation of the N1, and the proposed location of the closest wind turbines being 4 km from the N1, the wind turbines will not be viewed in the core field of vision of passing motorists, but would occur in their peripheral field of vision. A further factor that would mitigate the visual impact for motorists travelling this route is the fact that people's "cone of vision" narrows at high speed as they concentrate on the road ahead, and thus their perception of objects at the lateral extremities of their cone of vision declines. Motorists are, therefore, unlikely to have a heightened visual perception of the turbines when travelling at the speed limit.

However, there are some points along the N1 where motorists are likely to stop, and their perception of the proposed wind energy facility will increase at these points. One of these points is the Kuilfontein Farm Stall approximately 3km southeast of Springfontein where there is a junction with a connecting road to Springfontein. This and the filling station to the northeast of Springfontein are the points in the study area where the largest number of motorists can be expected to stop. Accordingly, two of the critical viewpoints are at these points.

8.6.5 Visual Impact

Numerical values were assigned to the different categories in terms of the criteria discussed above and the maps for each of these criteria were overlaid in a GIS programme to produce a composite map of Visual Impact (Figure 8.9). Values associated with the categories for each of the criteria were added and the resulting values were aggregated into three categories with equal numerical intervals to produce a map showing areas of high, medium and low visual impact. As can be seen from this map, medium and high visual impacts are restricted to the area within 10 km from the turbines. The following is of relevance:

» There are few areas of high visual impact. The areas of high visual impact correspond with areas of high viewer incidence (e.g. residential areas such as Springfontein and the farm homesteads in the study area) as well as the zone closest to the turbines (1-3 km from a turbine).
» The south-eastern cluster of turbines occurs in an area of low predominantly low visual impact, whilst the northern and western clusters occur in area of low to medium visual impact.
» There is a large area of medium visual impact to the north of the turbine positions, whilst the area around the south-eastern cluster of turbines will experience a low visual impact. This is primarily due to the linear ridges in the southern part of the study area that provide a limited degree of screening for the turbines.

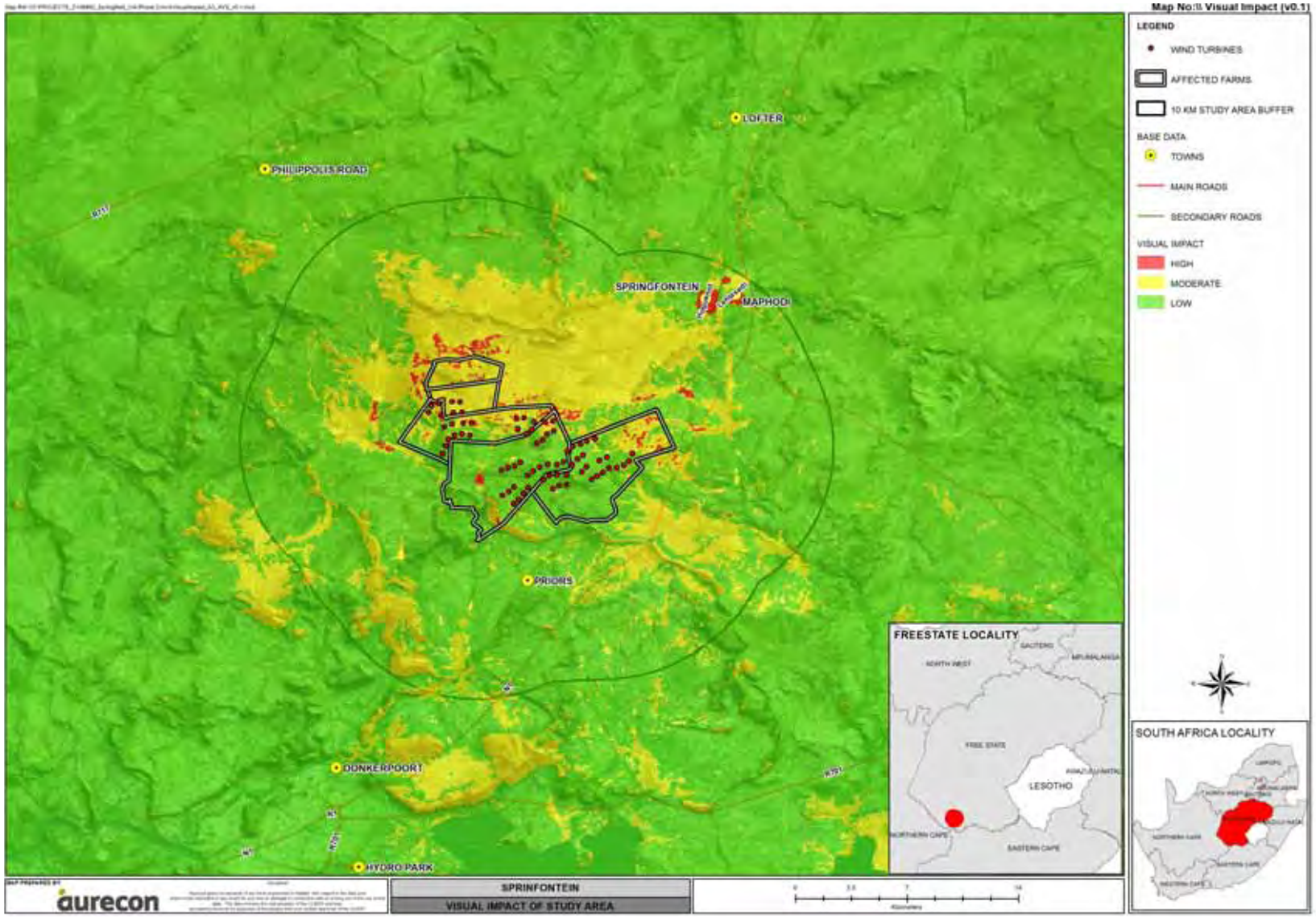

Figure 8.9: Visual Impact Index

8.6.6 Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the wind energy within the receiving environment. Refer to Visual Assessment (Appendix I) for the remainder of the photo-simulations. Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed wind energy facility within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions. The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout as indicated on **Figure 8.10 and Figure 8.11.**

Each photographic simulation is preceded by a panoramic overview of the landscape from the specified viewpoint being discussed. The panoramic overview allows for a more realistic viewer scale that would be representative of the distance over which the turbines are viewed. Where relevant, each panoramic overview indicates the section that was enlarged to show a more detailed view of the wind energy facility. The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility.

The photomontages show the following:

» The visual impact from Critical Viewpoints 1 and 2 along the N1 can be expected to be insignificant. There are the Kuilfontein Farm Stall, from where the turbines will be poorly visible due to distance (8 km to the closest turbine), and Springfontein, from where the turbines are unlikely to be visible due to an even larger distance from the closest turbine.
» The highest visual impacts for motorists travelling along the N1 will be experienced impacts close to Critical Viewpoint 3. However, there is some opportunity at this point for topographic screening of the turbines, especially when the wind energy facility is viewed from the south. Views of the turbines looking north are screened by linear ridges, so that the bases of the turbine towers will be blocked from view and only the top portion of the towers and the blades will be visible. A further mitigating factor with respect to the views of the turbines from the N1 is the fact that they will not be viewed “head-on” from the N1, and will appear peripherally in the viewers’ cone of vision.

Figure 8.10.: Photo simulation view from high point on Ou Spieonkop farm after turbine installation. Note that this viewpoint is not publicly accessible and therefore represents a worst case scenario impact much worse than what will be experienced by the general public.

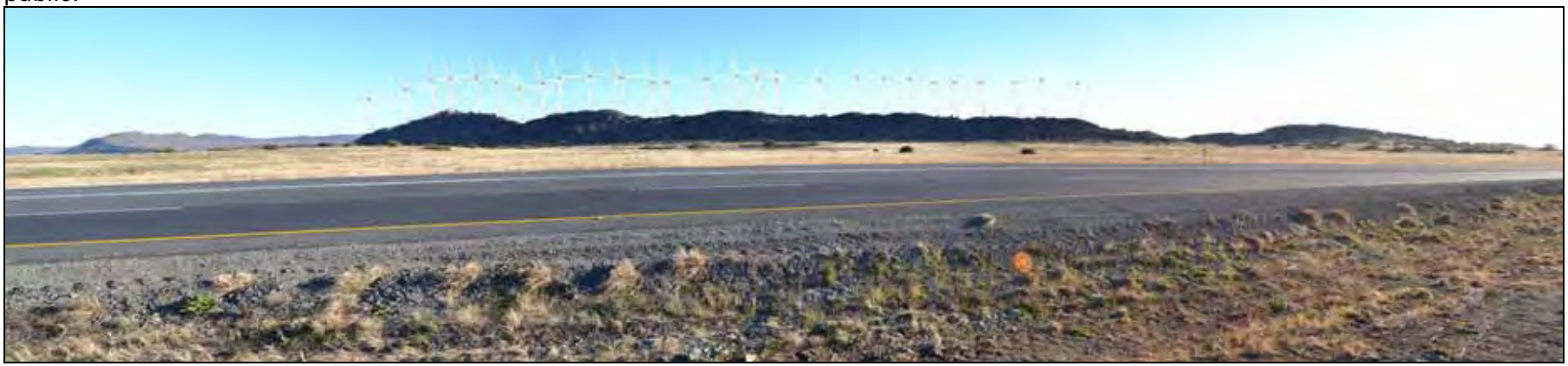

Figure 8.11.: Photo simulation view from the N1 after turbine installation showing screening of the turbine tower bases by a linear ridge

Impact Table - visual impact on residents of settlements and homesteads within 5 km from the site

Nature: Visibility of the turbines and associated infrastructure.		
	Without mitigation	**With mitigation**
Extent	(Regional) 3	(Regional) 3
Duration	(Permanent) 5	(Long term) 4[7]
Magnitude	(Minor) 3	(Minor) 3
Probability	(Definite) 5	(Definite) 5
Significance	**(Medium)55**	**(Medium)50**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible once turbines are removed at the end of life of the facility	Reversible once turbines are removed at the end of life of the facility
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes but the mitigation effectiveness is limited.	
Mitigation: » When planning roads, the edges should be organic or curvilinear rather than straight and sharp. Organic and irregular lines would blend in with the natural formation of the landscape and as a result minimise the visual impact. » It is not recommended to plant trees to screen the wind turbines, as this would detract from the predominantly treeless appearance of the natural landscape and would therefore introduce an additional incoherent pattern in the natural landscape. Besides the isolated ridgelines, this area is characterised by wide open grassy plains devoid of trees.		
Cumulative impacts: No other planned wind energy facilities are known in this region; therefore the potential for cumulative impacts of these wind energy facilities together with other wind energy facilities is limited. There is some potential for cumulative impacts with solar energy facilities in this area. However, due to the spatial separation between these facilities (the closest known solar facility will be located adjacent to Springfontein), and due to solar infrastructure being very small in comparison to wind turbines, the potential for cumulative impacts is very low.		
Residual Impacts: Little can be done to mitigate the visibility of turbines due to their size. The impact of the turbines will therefore largely remain in spite of mitigation.		

[7] It is assumed that the turbines will be removed after the 20 year life span of the wind energy facility

8.6.7 Change of visual character and sense of place of the region

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role. A visual impact on the "sense of place" is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the pastoral visual quality of the farmland and the scenic beauty of the coastline and of the mountains inland. The overwhelming character of the landscape is natural and agricultural, with a tranquil and relaxing atmosphere. The only major detraction from the tranquil agricultural atmosphere is the noise from the N1 in the east of the study area. However, to many local residents the N1 is not necessarily a source of disturbance due to its distance from settlements and that fact that this road to a great extent represents the lifeblood of the local economy. The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be moderate. There is no mitigation for this impact.

Impact Table - visual character and sense of place

Nature of Impact: Potential visual impact on the visual character and sense of place of the region.		
	No mitigation	***Mitigation Considered***
Extent	Regional **(3)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	Moderate **(6)**	N/A
Probability	Probable **(3)**	N/A
Significance	**Moderate (39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		

Cumulative impacts:
The construction of up to 74 wind turbines will increase the cumulative visual impact within the region.
Residual impacts:
None. The visual impact of the wind turbines will be removed after decommissioning.

8.6.8 Lighting Impacts

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow in an otherwise dark environment. Lighting impacts will be moderate significance both before and after mitigation.

Light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity to the wind turbines.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

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 intensity of light generated by the wind energy facility is expected to be of a low significance.

Impact Table - Significance of visual impact of lighting at night on visual receptors in close proximity to the proposed wind energy facility

Nature: Sky glow from lighting of the facility		
	Without mitigation	**With mitigation**
Extent	(Regional) 3	(Regional) 3
Duration	(Permanent) 5	(Long Term) 4[8]
Magnitude	(Low) 4	(Low) 3
Probability	(Improbable) 2	(Improbable) 2
Significance	**(Low)24**	**(Low)20**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Utilize light sources of minimum intensity necessary to accomplish the light's purpose; » Turning lights off using a timer or occupancy sensor when they are not needed; » Improving lighting fixtures, so that they direct their light more accurately towards where it is needed, and with fewer side effects. » No "architectural uplighting" of structures should be employed i.e. the turbines themselves must not be illuminated. » Only "full cut-off" light fixtures that direct light only below the horizontal plane (must be used. These lights aim light downward and sideways, thereby avoiding uplighting.		
Cumulative impacts: No other planned wind energy facilities or other large sources of lighting are known in this area.		
Residual Impacts: Residual impacts will be very low once mitigation measures are implemented or once offensive lighting is removed.		

8.6.9 Shadow flicker

Shadow flicker occurs when the sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "most shadow impact is associated with

[8] It is assumed that the turbines will be removed after the 20 year life span of the wind energy facility

3-4 times the height of the object". Based on this research, a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring. In this respect, inhabited settlements and homesteads within the site, as well as those within 500m of the property boundary may experience a visual impact of low significance both before and after mitigation.

Shadow flicker only becomes an issue if a wind turbine is in close proximity to houses / dwelling. To avoid shadow flicker, Mainstream should institute turbine separation distances to avoid shadow flicker. Taking into account site constraints Mainstream should use a minimum spacing of 5 rotor diameters (approximately 560m) based on the maximum turbine envelope in the prevailing (bi-directional east west) wind directions, 3 rotor diameters (approximately 336m) for non-predominant.

Impact Table - Significance of visual impact of shadow flicker

Nature: Shadow flicker ue to win turbines		
	Without mitigation	**With mitigation**
Extent	(Local) 2	(Local) 2
Duration	(Short) 1	(Short) 1
Magnitude	(Low) 4	(Low) 4
Probability	(Improbable) 1	(Improbable) 1
Significance	**(Low)7**	**(Low)7**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Should there be complaints about shadow flicker at specific residences, it is recommended that blinds be fitted on windows of residences that are affected.		
Cumulative impacts: No other planned wind energy facility are known in this area.		
Residual Impacts: Very limited residual impacts possible after implementation of mitigation.		

8.6.10The potential to mitigate visual impacts

It is not possible to mitigate the primary visual impact, namely the appearance of the wind energy facility (the wind turbines). The functional design of the turbines cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not

permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The overall potential for mitigation is generally low or non-existent. The following measures can be considered:

» The main mitigation measure during the construction phase will be effective rehabilitation of the construction camps (including temporary access roads, laydown areas and worker camps) and all other areas affected by the construction works.
» Security and construction lighting should, as far as possible, not be focused on temporary structures and construction works. Where this is unavoidable, lighting should be as unobtrusive as possible and reflectors can be used to avoid light spillage.
» Utilize light sources of minimum intensity necessary to accomplish the light's purpose;
» Turning lights off using a timer or occupancy sensor when they are not needed;
» Improving lighting fixtures, so that they direct their light more accurately towards where it is needed, and with fewer side effects.
» No “architectural uplighting” of structures should be employed i.e. the turbines themselves must not be illuminated.
» Only “full cut-off” light fixtures that direct light only below the horizontal plane (must be used. These lights aim light downward and sideways, thereby avoiding uplighting
» Provision should be made for completely dismantling the turbines upon decommissioning and for rehabilitating disturbed areas.
» When planning roads, the edges should be organic or curvilinear rather than straight and sharp. Organic and irregular lines would blend in with the natural formation of the landscape and as a result minimise the visual impact.

8.6.11Cumulative impacts

Based on the information available at the time of undertaking this EIA, no other wind energy facilities that have an environmental authorisation or occur in close proximity to the Springfontein site. Therefore the potential for cumulative impacts of these wind energy facilities together with other wind energy facilities is limited. There is some potential for cumulative impacts with solar energy facilities in this area. However, due to the spatial separation between these facilities (the closest known solar facility will be located adjacent to Springfontein), and due to solar infrastructure being very small in comparison to wind turbines, the potential for cumulative impacts is very low.

8.6.12Comparative Assessment of Alternatives

Should the substation be located at the vacant Besembos Substation site, a new power line of approximately 4.2km in length would be required to be constructed from the Besembos substation parallel to the existing 132 kV power line (alternative grid connection). The resultant doubling up of the power line would make this line more visually noticeable. The Besembos Substation, although already fenced, is completely undeveloped and therefore no valid motivation could be made from a visual perspective to develop the substation at Besembos rather than at the substation sites further north. Therefore the preferred grid connection is supported. From a visual perspective, no preference if give to the location of the construction compound/ offices/ laydown area. All are in acceptable locations.

8.6.13Conclusions and Recommendations

The construction and operation of the proposed Springfontein Wind Energy Facility and its associated infrastructure will have a visual impact on the visual environment especially within, but not limited to the area within 5km of the proposed facility. Beyond this visual impact is limited.

The physical characteristics of the area (generally flat topography and low vegetation cover) which allows for wide vistas, ensures a high level of visual sensitivity. The study area is characterised by undisturbed natural landscapes, but has no resources of critical importance or any major scenic attractions and also has a fairly low visual diversity (i.e. only two landscape types, namely flat plains and small hills). It is also to be noted that no cultural landscapes of importance have been identified by the heritage specialists for this site. Therefore, the combination of the moderate visual quality and the lack critical scenic resources in the study area results in a moderate visual impact for the proposed wind energy facility of the surrounding area.

There are localised areas of higher visual sensitivity that should be avoided, if possible due to their rarity in this context. The construction phase of the project will have a higher visual impact than the operational phase, since clearance of vegetation for the construction of roads and for the construction of the turbine foundations will be more visible during and immediately after construction, but will decrease over time as vegetation re-establishes.

Due to the flatness of the landscape, lack of visual absorption capacity (besides the ridges) and the height of the turbines, views of the wind turbines cannot be mitigated. The ridges will screen the turbines from view only if the viewer is

located very close to a ridge on the opposite side of the ridge to the turbine. The majority of the viewers in the study area would never be in such a position and the ridges would therefore only provide partial screening of the turbines. The turbines will therefore be visible from a large area around the wind energy facility. However, it is fortunate that the closest turbine to the N1 is approximately 4 km from this road, which lessens the significance of its visual impact.

There are no visual fatal flaws associated with the project and that the visual impacts can be expected to be of moderate significance.

8.7 Assessment of Potential Noise Impacts

8.7.1 Relevant Noise Receptors

Besides the small town of Springfontein to the west of the study area, the proposed wind energy facility will be situated in a rural area. The wind energy facility poses no noise risk to this community. Figure 8.12 shows the Noise Sensitive Developments (NSDs) in and around the site. NSD01, NSD05 and NSD11 are located within 1km of wind turbines, however based on the specialist noise impact assessment the potential noise impact would be insignificant during both the construction and operational phases of the project.

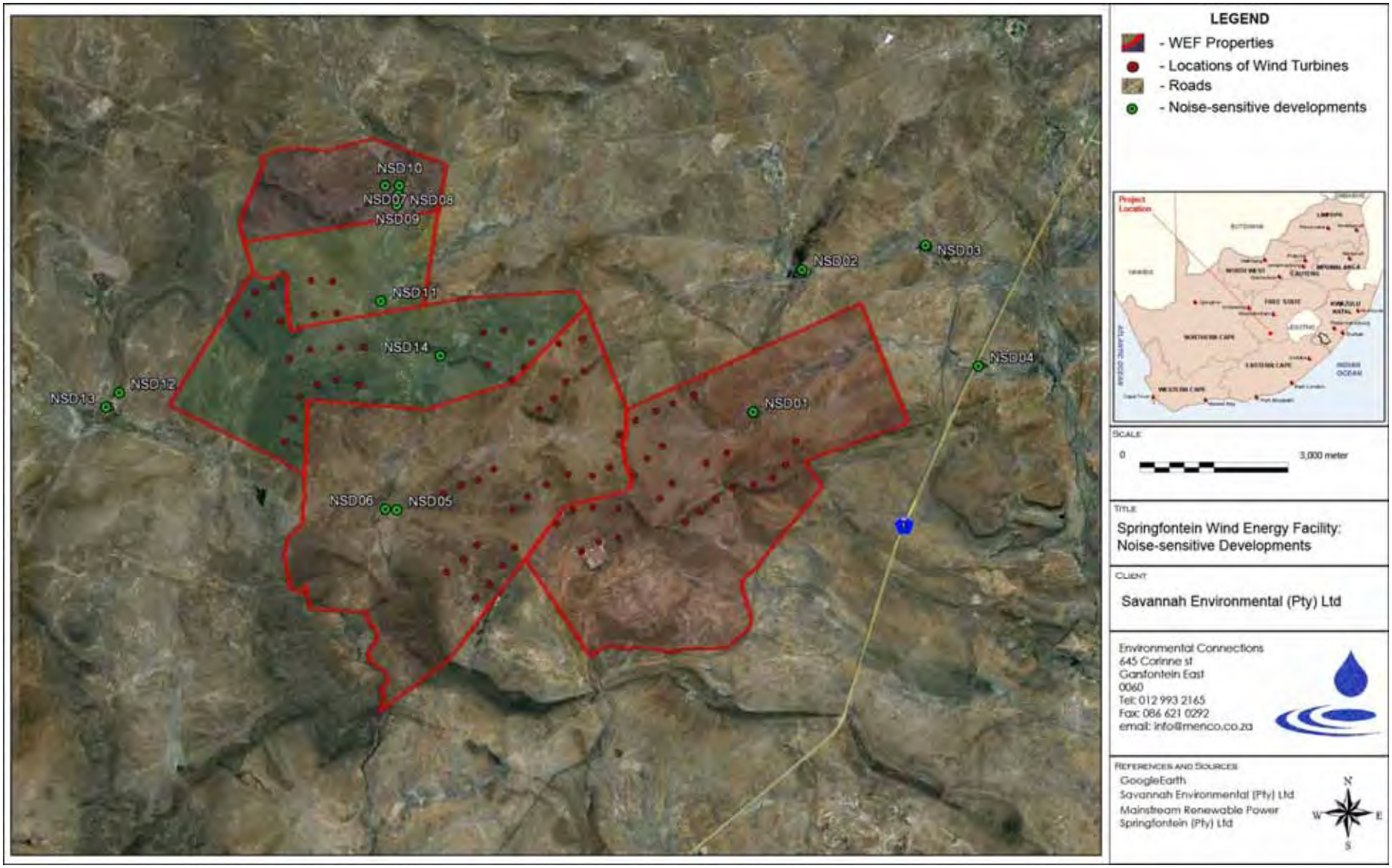

Figure 8.12: Aerial image indicating potential noise sensitive receptors and property boundaries for the Springfontein Wind Energy Facility

8.7.2 Noise from Construction activities

Noise sources during construction include the following:

» **Construction equipment**
Construction equipment likely to be required will typically include excavator/graders, bulldozers, dump trucks, vibratory roller, bucket loader, rock breaker(s), drill rig, flat-bed truck(s), pile drivers, concrete trucks, cranes, fork lift(s) and various 4WD and service vehicles. Octave sound power levels typical for this equipment are presented in the Noise report.

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

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

» **Traffic due to construction vehicles**
A source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the wind turbine. Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

Results of Noise Modelling – Construction Noise

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

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

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

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

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

Nature:	Numerous simultaneous construction activities that could impact on receptors.
Acceptable Rating Level	Rural district with little road traffic (excluding construction traffic): 45 dBA outside during day Use of $L_{Req,D}$ of 45 dBA for rural areas Ambient sound level = 28 dBA
Extent ($\Delta L_{Aeq,D}$>7dBA)	**Local**– Change in ambient sound levels would not extend further than 1,000 meters from activities **(2).**
Duration	**Temporary**– Noisy activities in the vicinity of the receptors

	would last a portion of the construction period **(1)**
Magnitude	Ambient noise levels <Rating Level **Low (2) – Medium (6)**
Probability	Due to change in ambient sound levels there is a possibility that NSD11 may complain. **Possible (2).**
Significance	**Low (18)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Comments	-
Can impacts be mitigated?	*Yes, though mitigation not required.*
Mitigation:	*Not required.*
Effectiveness of mitigation:	*Not applicable, mitigation not required*
Cumulative impacts:	This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

8.7.3 Noise Sources: Operational Phase

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

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

» **Noise from the Wind Turbines: Aerodynamic sources[9]**
Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:
- Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge
- Noise due to inflow turbulence (turbulence in the wind interacting with the blades)

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

- Discrete frequency noise due to trailing edge thickness
- Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade)
- Noise generated by the rotor tips

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

Results of Noise Modelling – Operational Phase

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

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

Based on the preceding figures it is obvious that the risk of a noise impact developing is very low. The operation of the Springfontein wind energy facility will not have a noise impact on any of the current noise-sensitive developments.

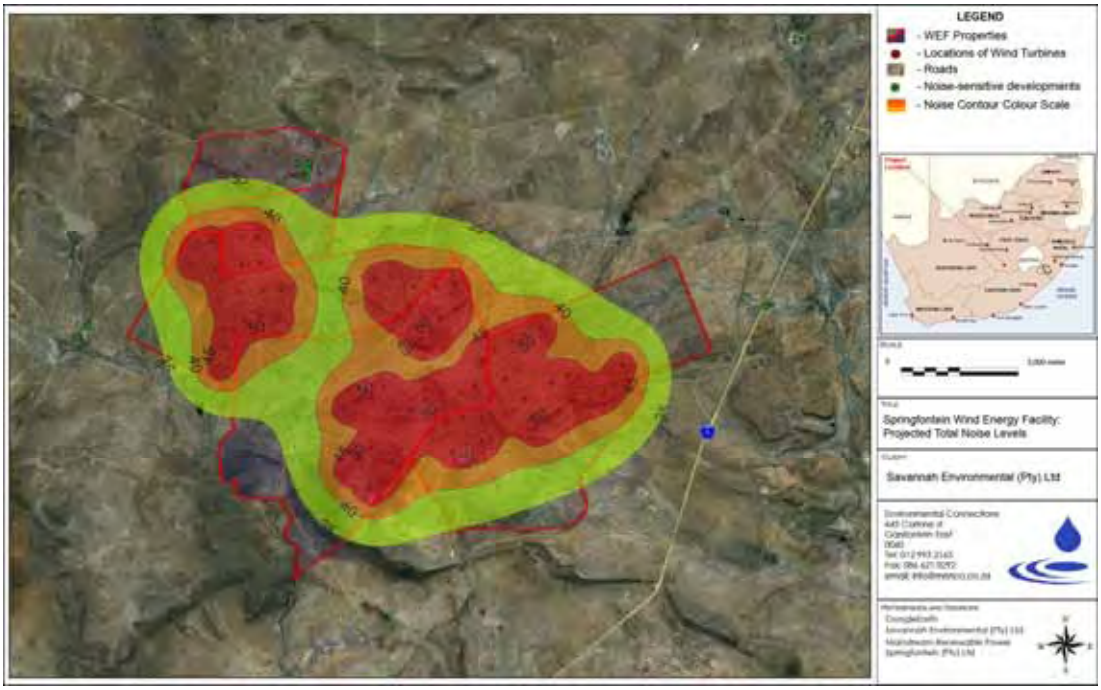

Figure 8.13: Projected Night-time Noise Levels (ISO model) from the wind energy facility; Contours of constant sound levels for a 6 m/s wind

The change in ambient sound levels is illustrated in **Figure 8.14**

Figure 8.14: Projected change in ambient sound levels (ISO model); Contours of constant sound levels for a 6 m/s wind

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

Nature:	*Numerous turbines operating simultaneously during a period when a quiet environment is desirable.*
Acceptable Rating Level	Rural district with little road traffic.
Extent ($\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact will extend less than 1,000 meters from activity. **(2).**
Duration	**Long** – Facility will operate for a number of years **(4).**
Magnitude	**Low-medium (4)**
Probability	**Possible (3) for NSDs 01, 11 and 14[10]**
Significance	**30 (Low)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Comments	-
Can impacts be	No noise impact

[10] Note: This is a hunting camp used infrequently

mitigated?	
Mitigation:	*Not required*
Cumulative impacts:	This impact is cumulative with existing ambient background noises.
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

8.7.4 Comparative Assessment of Grid Connection Options

Transformer noises (Substation)

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

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

Transmission Line Noise (Corona noise)

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

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations.

Corona noise can be characterised as broadband 'crackling' or 'buzzing', but fortunately it is generally only a feature during fog or rain.

Corona discharges results in:

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

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

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

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

8.7.5 Cumulative impacts

Cumulative impacts of multiple turbines are addressed under Section 8.6.2 and 8.6.3. There are no other existing or proposed wind energy facilities in close proximity to the Springfontein site. Therefore cumulative noise impacts of from the facility is limited and of low significance.

8.7.6 Conclusions and Recommendations

By making use of predictive models to identify noise issues of concern, the noise assessment indicated that the proposed project will have a noise impact of low significance on all NSDs in the area during both the construction and operational phases using the Vestas V90 3.0MW wind turbine. However, mitigation measures are still proposed to reduce the potential noise impacts and risks to receptors.

With the input data as used, this assessment indicated that the potential noise impact would be insignificant during both the construction and operational phases.

It should be noted that the noise impact was determined based on the outcome of a regression analysis that indicated that the likely long-term ambient sound levels could be significant during periods when wind speeds exceeds 4 m/s. The regression analysis is based on a number of measurements taken at various sites during periods when the wind was blowing, but when there were little other noise sources. No further ambient sound measurements are recommended prior to the development of the wind energy facility, yet quarterly noise measurements are recommended for the first year of operation.

Noise measurements are recommended at NSD01, NSD05 and NSD11 over a period of at least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer. If a valid and reasonable noise complaint is registered relating to the operation of the facility additional noise monitoring should be conducted by an acoustic consultant during the quarterly noise measurements. Noise monitoring must be continued as long as noise complaints are registered.

Currently no wind turbines are within 1 000 metres from a NSD. If any wind turbines are added within 1 000 meters from any NSD, the developer should re-evaluate the layout . The findings of this report should also be made available to all potentially noise-sensitive developments in the area, or the contents explained to them to ensure that they understand all the potential risks that the development of a wind energy facility may have on them and their families.

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

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

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

8.8 Assessment of Potential Impacts on Heritage - Archaeology

No sites of heritage potential could be identified in the proposed study area. Although no heritage sites could be identified on the surface, subsurface Stone Age remains could still be found. People involved in excavations should be made attentive to this. South African War sites that do leave little or no surface remains could be found in the area.

Impact Table – Impact of Construction on heritage artefacts

Nature: Possible damage to heritage sites		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**36 (Medium)**	**24 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	Yes
Mitigation: If concentrations of archaeological materials are exposed during construction then all work must stop for an archaeologist to investigate. If any human remains (or any other concentrations of archaeological heritage material) are exposed during construction, all work must cease and it must be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency, so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material. Recommendations will follow from the investigation.		
Cumulative impacts: None		
Residual Impacts: None		

8.8.1 Comparative Assessment of Alternatives

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

8.8.2 Cumulative impacts

Based on the information available at the time of undertaking this EIA, no other wind energy facilities that have an environmental authorisation or occur in close proximity to the Springfontein site. Therefore cumulative impacts on heritage resources will be limited to the site itself.

8.8.3 Conclusions and Recommendations

No heritage sites occur within the development footprint of the proposed for infrastructure for the Springfontein Wind Energy Facility. The archaeology study indicated that there is a very slight chance of encountering sites of Iron Age origin or sites within the Built Environment components. More likely will be the occurrence of sites within the Stone Age and Palaeontological as well as the Historic spheres. Site investigation of the turbine placements and associated infrastructure showed no indications of any Stone Age or historic sites.

There is a possibility of conflict sites from the South African War being located on some of the ridges identified for the placement of the turbines (these are strategic both in military as well as wind energy terms). The location of these sites is often only documented and very little or no evidence is found on the ground or under the ground.

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

8.9 Assessment of Potential Impacts on Palaeontology

8.9.1 Findings or Loss of Fossils during Construction

The construction phase of the wind energy facility will entail excavations into the superficial sediment cover (soils, etc.) and perhaps also into the underlying bedrock. These include excavations for the turbine foundations, buried cables,

new internal access roads and foundations for associated infrastructure such as an on-site substation and workshop / administration building. In addition, sizeable areas of potentially fossiliferous bedrock may be sealed-in or sterilised by infrastructure such as hard standing areas for each wind turbine, lay down areas and internal access roads. All these developments may adversely affect potential fossil heritage within the study area by damaging, destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good. Once constructed, the operational and decommissioning phases of the wind energy facility will not involve further adverse impacts on palaeontological heritage.

In general, the destruction, damage or disturbance out of context of fossils preserved at the ground surface or below ground that may occur during construction represents a negative impact that is limited to the development footprint. Such impacts can usually be mitigated but cannot be fully rectified (i.e. permanent). Because of the generally sparse occurrence of fossils within most of the formations concerned as well as within the overlying superficial sediments (soil, etc.), as inferred from better exposed localities elsewhere, the magnitude and probability of impacts are conservatively rated as low.

The overall impact significance of the construction phase of the proposed wind farm project is assessed as low (negative) without mitigation. It should be noted that, should fossils be discovered before or during construction and reported by the responsible ECO to the responsible heritage management authority (SAHRA) for professional recording and collection, as recommended here, the overall impact significance of the project would be further reduced. Residual negative impacts from any loss of fossil heritage would be partially offset by an improved palaeontological database as a direct result of appropriate mitigation. This is a positive outcome because any new, well-recorded and suitably curated fossil material from this palaeontologically under-recorded region would constitute a useful addition to our scientific understanding of the fossil heritage here.

The intent of mitigation and lessening of impact is to identify fossil localities for future avoidance or to recover in situ fossils before possible damage or destruction.

The area is characterised by fossiliferous mudstones and sandstones. Several dolerite sills and dykes occur in the region and are often found capping hills and forming ridges. Dolerite, being of igneous origin, is devoid of fossils. In addition fossils are usually absent in the sedimentary rocks immediately adjacent to the dolerite intrusions. There is no palaeontological concern in the instances where the proposed construction is situated on dolerite, which would probably be the case with wind turbines which will be constructed on the hill tops.

Care should be given however to constructions such as access routes, construction facilities, substations, pylons and buildings which would not be limited to dolerite. It is recommended that a palaeontological surface survey of the site is conducted in all the non-doleritic areas prior to construction where construction is planned.

In addition the ECO should photograph and record the position of fossiliferous material when exposed during construction. If the fossiliferous material is going to be damaged during construction, the ECO could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, palaeontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist. A professional palaeontologist should be appointed to salvage and collect fossiliferous material from the site which may exposed during construction.

The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from the South African Heritage Resources Agency. The fossils should be donated to the Bloemfontein Museum.

Impact Table – Impact on fossil heritage resources during the construction phase

Nature: Potential paleontological heritage identified in the affected area could be negatively affected during the construction phase (excavations) of the development.		
	Without mitigation	**With mitigation**
Extent	Local High (5)	Local Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	improbable (2)
Significance	**Medium (50)**	**(Low) 24**
Status (positive or negative)	Negative	Positive
Reversibility	Improbable	Possibility
Irreplaceable loss of resources?	High	High
Can impacts be mitigated?	Yes	
Mitigation: » Care should be given however to constructions such as access routes, construction facilities, substations, pylons and buildings which would not be limited to dolerite. It is		

recommended that a palaeontological surface survey of the site is conducted in all the non-doleritic areas prior to construction where construction is planned.

» An ECO should photograph and record the position of fossiliferous material when exposed during construction. If the fossiliferous material is going to be damaged during construction, the ECO could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, palaeontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist. A professional palaeontologist should be appointed to salvage and collect fossiliferous material from the site which may exposed during construction.

» The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from the South African Heritage Resources Agency. The fossils should be donated to the Bloemfontein Museum.

8.9.2 Comparative Assessment of Alternatives

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

8.9.3 Cumulative impacts

The cumulative impact on fossils from the Springfontein wind energy facility will not have a significant impact on palaeontology.

8.9.4 Conclusions and Recommendations

The proposed development located within igneous bedrock (dolerite) represents no major paleontological impact.

8.10 Impacts associated with the Proposed Power line

A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:

- **Preferred Grid Connection Option**

  The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop out 132 kV power line of up to 500m in length, is proposed.

- **Alternative Grid Connection Option:**

The alternative grid connection option includes building a new 132 kV substation on farm Stock Port RE/283 as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockpoort. The length of this new power line would be ~4200m.

This proposed substation will have a high-voltage (HV) yard footprint of approximately 1 hectare.

The impacts of the power line have been assessed under each heading in this Chapter. In summary, the impacts of the power line include:

» Negative impact on vegetation and soil structure during construction of the power line and associated access roads (low significance rating).
» Disturbance (intrusion impacts) to residents / farmers living in close proximity to where the power line is being constructed (low significance rating).
» Operational impact: Bird mortality due to the power line (low significance rating).
» Operational impact: Visual impact on surrounding area (low significance rating).

Regarding the grid connection options, the option which results in the shortest length of new power line would be the preferred option from an environmental point of view due to the reduced degree of disturbance compared to the Alternative option (i.e. the shorter length of power line (~500m) compared to the 4200m length of power line for the Alternative option (connection to the planned Besembos Substation)). In additional, visual and potential impacts on avifauna will also be reduced due to a shorter length of power line. Therefore the technically preferred loop-in loop-out connection from the on-site substation to the Besembos-Signal 132kV line is also preferred from an environmental perspective.

CONCLUSIONS AND RECOMMENDATION CHAPTER 9

South Africa Mainstream Renewable Power Springfontein (Pty) Ltd ("Mainstream") is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Kopanong Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) is within the Free State Province, and lies approximately 12 km south west of Springfontein. Up to 74 wind turbines are proposed to be constructed over a broader area of approximately 83 km^2 in extent. The proposed facility would be known as the Springfontein Wind Energy Facility.

The site is proposed on the following farm portions:

» Remaining Extent of the farm Stock Port 283;
» The farm Bankfontein 519;
» The farm Mistkuil. 412;
» The farm Ou Spioenkop 467 and
» The Remaining Extent of the farm Spioenkop 461

The project will include the following infrastructure:

» The site is proposed to accommodate up to 74 wind turbines. The facility would be operated as a single facility with each turbine being between 1.4 MW and 4 MW in capacity. The capacity of the facility will be ~170MW.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 2m), a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades.
» Internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded, where possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (100 m x 100 m) to facilitate grid connection.
» A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:
    o **Preferred Grid Connection Option**
      The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-

Signal 132kV line a loop-in and loop out 132 kV power line of up to 500m in length, is proposed.

- **Alternative Grid Connection Option:**
  The alternative grid connection option includes building a new 132 kV substation on farm Stock Port RE/283 as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockpoort. The length of this new power line would be ~4200m. The proposed substation will have a high-voltage (HV) yard footprint of approximately 100m X 100m.

» Up to 2 permanent wind measuring mast(s) of 70 m – 120 m (height), lattice structure

The environmental impact assessment (EIA) for the proposed Springfontein Wind Farm has been undertaken in accordance with the EIA Regulations published in Government Notice 33306, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998) and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

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

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - N provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Draft EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility and the associated infrastructure, including the substation and overhead power line. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by Mainstream. This layout includes 74 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Mitigation to avoid impacts are primarily associated with the relocation of certain turbine positions of concern, as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft Environmental **Management Programme (EMP)** included within **Appendix O**.

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

9.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 74 turbines and associated infrastructure. Table 9.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 5, the significance weightings for potential impact have been rated as follows:

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

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

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Loss or fragmentation of vegetation & protected plant species	Medium	Low
Impacts on Watercourses / Drainage Lines	Medium	Low
Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.	Medium	Low
Impact on threatened animals species / habitat	Low	Low
Alien vegetation growth due to disturbance	Medium	Low
Loss of habitat within indigenous natural vegetation types, disturbance and soil erosion due to creation of permanent access roads.	Medium	Low
Impacts on Avifauna		
Bird mortalities due to collisions with wind turbines	High	Medium
Impact on birds due to disturbance of habitat	Medium	Low
Loss of avifauna habitat	Medium	Low
Electrocution/ collision of birds with the power line	Medium	Low
Impacts on Bats		
Disturbance and/or destruction of bat roosts due to construction activities	Medium	Low
Bat fatalities due to collision or barotrauma while foraging	High	Medium
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with high agricultural potential and land capability and impact on land-use	Low	Low
Soil Erosion / degradation during construction	High	Low
Soil contamination / soil erosion during the operation of the facility	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase (Positive Impact)	Medium	Medium
Impact of the presence of construction	Low	Low

Nature	Without mitigation	With mitigation
workers in the area on local communities		
Risk of Stock theft and damage to farm infrastructure	Medium	Low
Increased risk of fires during construction	Medium	Low
Increases traffic on roads due to construction	Low	Low
Damage to and loss of farmland during construction	Medium	Low
Benefits associated with the establishment of a community trust	Medium	Low
Operational Phase -Creation of Long- Term employment and business opportunities	Low	Medium
Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa	Medium	Medium
Long-Term Impact of the project on Existing Farming Activities on the Site	Low	Low
Impact of the wind energy facility on tourism in the region	Low	Low
Health Impacts due to the Operation of the wind energy facility	Low	Low
Visual Impacts		
Change in visual character and sense of place	Medium	N/A
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	Low	Low
Shadow Flicker	Low	Low
Noise Impacts		
Noise impacts due to construction activities	Low	Low
Noise impacts from the wind turbines – operational phase	Low	Low
Impacts on Heritage Artefacts		
Impact of construction on archaeology	Medium	Low
Potential Impacts on Palaeontology		
Findings or Loss of Fossils during Construction	Medium	Low

9.1.2 Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat and impacts on soils. A wind energy facility is, however, dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 83 km^2 was considered for the facility, of which ~1.6% will be utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed. The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Permanently affected areas comprise 74 turbine footprints (74 foundation areas of 20m x 20m), access roads (up to 10 m in width), one 132 kV substation footprint (100 x 100m) and an operations and service building area (100m x 100m). The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
74 turbine footprints (each 20m x 20m)	29600
Permanent access roads within the site (10 m width and 21600 m in length)	86400
One on-substation footprint (100m x 100m)	10000
Operations and service building area (100m x 100m)	10000
TOTAL	136000 m^2 (of a total area of 83000000m^2) **i.e. 1.6% of site**

Note that the areas of permanent disturbance calculated above does not include the power line (which is a linear activity). Therefore the calculation above plus the power line will make up the total area of permanent disturbance.

Temporarily affected areas comprise 74 foundation areas, laydown areas for turbines (each laydown area assumed to have a footprint of 2400m^2) and possibly a track of 11 m in width if a crawler crane is required to move across the site (i.e. an additional 6 m width to the permanent road of 8 m in width). The use of a crawler crane is not desirable and will be avoided if at all possible. The area of temporary disturbance is as follows:

Facility component - temporary	Approximate area/extent (in m^2)
74 turbine laydown areas (2400m^2 per turbine)	177600
Temporary crane travel (11 m) track (will be avoided if possible) on top of the permanent access road (6m in width) and 21600 m in length	129600
Temporary Compound	5000
Main Lay Down Area	10000
TOTAL	322200 (of a total area of 83000000m^2) = **3.9 % of site**

Therefore, ~4% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Springfontein wind energy facility.

9.2. Comparative Assessment of Grid Connection Alternatives (Substation & Power Line)

A 132 kV power line will connect the substation to the electricity distribution network/grid. The options for grid connection are as follows:

- **Preferred Grid Connection Option**
  The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop out 132 kV power line of up to 500m in length, is proposed.
- **Alternative Grid Connection Option:**
  The alternative grid connection option includes building a new 132 kV substation on farm Stock Port RE/283 as well as a new power line to the future planned Eskom Besembos Substation (which is located at the boundary of Farm Stockpoort. The length of this new power line would be ~4200m. This proposed substation will have a high-voltage (HV) yard footprint of 100m x 100m.

The impacts of the power line have been assessed in detail in Chapter 8. In summary, the impacts of the power line include:

» Negative impact on vegetation and soil structure during construction of the power line and associated access roads (low significance rating).

» Disturbance (intrusion impacts) to residents / farmers living in close proximity to where the power line is being constructed (low significance rating).
» Operational impact: Bird mortality due to the power line (low significance rating).
» Operational impact: Visual impact on surrounding area (low significance rating).

Regarding the grid connection options, the option which results in the shortest length of new power line would be the preferred option from an environmental point of view due to the reduced degree of disturbance compared to the Alternative option (i.e. due to the short length of power line (~500m) compared to the 4200m length of power line for the Alternative option (connection to the planned Besembos substation)). In additional, visual and potential impacts on avifauna will also be reduced due to a shorter length of power line. **Therefore the technically preferred loop-in loop-out connection from the on-site substation to the Besembos-Signal 132kV line which traverses the site is also nominated as the preferred from an environmental perspective.**

9.3. Comparative Assessment of Location of Other Infrastructure

In terms of the different location of associated infrastructure, the following locational alternatives are nominated as the preferred alternatives which have been appropriately sited from an environmental perspective:

» The proposed substation and O&M Building are preferable to the alternative locations on account of the proximity of the alternative locations to sensitive areas.
» The laydown and temporary camp locations are acceptable and preferable to the alternative locations, but either would be acceptable from an environmental perspective.

9.4. Cumulative Impacts

Based on the information available at the time of undertaking the EIA, no other wind energy facilities are proposed in the immediate region (i.e. within 20km of the Springfontein site). The only other renewable energy project which is situated near Springfontein is a proposed PV facility, known as theValedora 85MW Solar project, for which an EIA is underway. Therefore there were no renewable energy projects with preferred bidder's status in this region of the Free State at the time of writing this EIA report. Therefore no cumulative impacts arising from similar types of development have required assessment. However, incremental cumulative impacts (associated with multiple wind turbines within a single area)

have been considered within the detailed specialist studies (refer to Appendices F – N) and include:

» Cumulative impacts on ecology;
» Cumulative impacts on avifauna; and
» Cumulative Impacts land-use on the site

These are rated as to be of medium impact significance, the use of the EMP would assist in mitigating these negative impacts.

9.5. Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Springfontein Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 9.1 and A3 map in Appendix P**). The following sensitive areas/environmental features have been identified on the site:

» Drainage lines. The major sensitive features present are the drainage lines and a non-perennial river (the Donkerpoortspruit). These areas are considered sensitive ecosystems and should be avoided as far as possible. These support the ecosystems in the areas and may provide habitat for priority avifauna / bat / floral and faunal species and are areas sensitive to soil erosion. The drainage features have largely been avoided by the facility layout by applying a 200m buffer to these watercourses. The few turbines within the drainage areas can be moved slightly to avoid the sensitivity prior to finalising the layout.
» Large rocky hills in the southern portion of the site and the steep south-facing slopes along some of the lower rocky hills. There are a number of turbines in close proximity to some of the areas identified as important south-facing slopes. As many of these areas are very narrow or limited in extent, minor adjustment of the turbine positions would usually be sufficient to avoid the sensitive areas. Development in proximity to these areas should however proceed with caution and additional precautions to ensure that impacts on sensitive habitats as well as on protected and listed plant species are minimised, may be necessary.
» Those turbines within the plains are generally not of great concern given the homogenous nature of the habitat and the associated low ecological risk associated with development in these areas.
» Potential areas for the occurrence of populations of Red List fauna and flora that have been evaluated as having a probability of occurring in natural habitats within the study area. Apart from the listed species, a number of provincially protected species are present on the site including *Aloe broomii*, *Ammocharis coranica* and *Euphorbia clavarioides* var. *clavarioides*.

» Noise sensitive receptors (farmsteads on/around the site, albeit limited). NSD01, NSD05 and NSD11 are located within 1km of wind turbines, however based on the specialist noise impact assessment the potential noise impact would be insignificant during both the construction and operational phases of the project.
» Habitat for birds and bats (including steep slopes, drainage lines and foraging areas). These areas are subject to further bird and bat monitoring.

Note that no surface heritage artefacts were found on the site.

No absolute environmental 'no go' areas were identified. Turbine positioning should take cognisance of sensitive areas (as indicated on Figure 9.1). Should mitigation measures in the EMP be adhered to, impacts on the identified sensitive areas can be adequately managed.

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most significant potential impact. The proposed facility is likely to have a moderate, long-term impact on the avifauna of the area, and may negatively affect key rare, red-listed and/or endemic species. A number of focal or target species were identified, but of particular concern are Blue Crane, Blue Korhaan, Ludwig's Bustard, Secretarybird, Greater Flamingo and Verreaux's Eagle and Lesser Kestrel. Raptors often utilise high wind conditions to soar and hover along ridges, while looking downwards and hunting, which places them at risk of collision with turbine blades. These birds may be disturbed by construction of the facility, lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (bustards and flamingos), or may suffer mortalities in collisions with the turbine blades and power lines. Such effects can probably be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme, mainly involving careful and responsible development and management of the facility, with sensitivity to potential, negative impacts and a preparedness to adjust operating procedures in a sincere effort to mitigate such impacts.

Planning of infrastructure location on the site 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 underground cable alignments should coincide as much as possible.

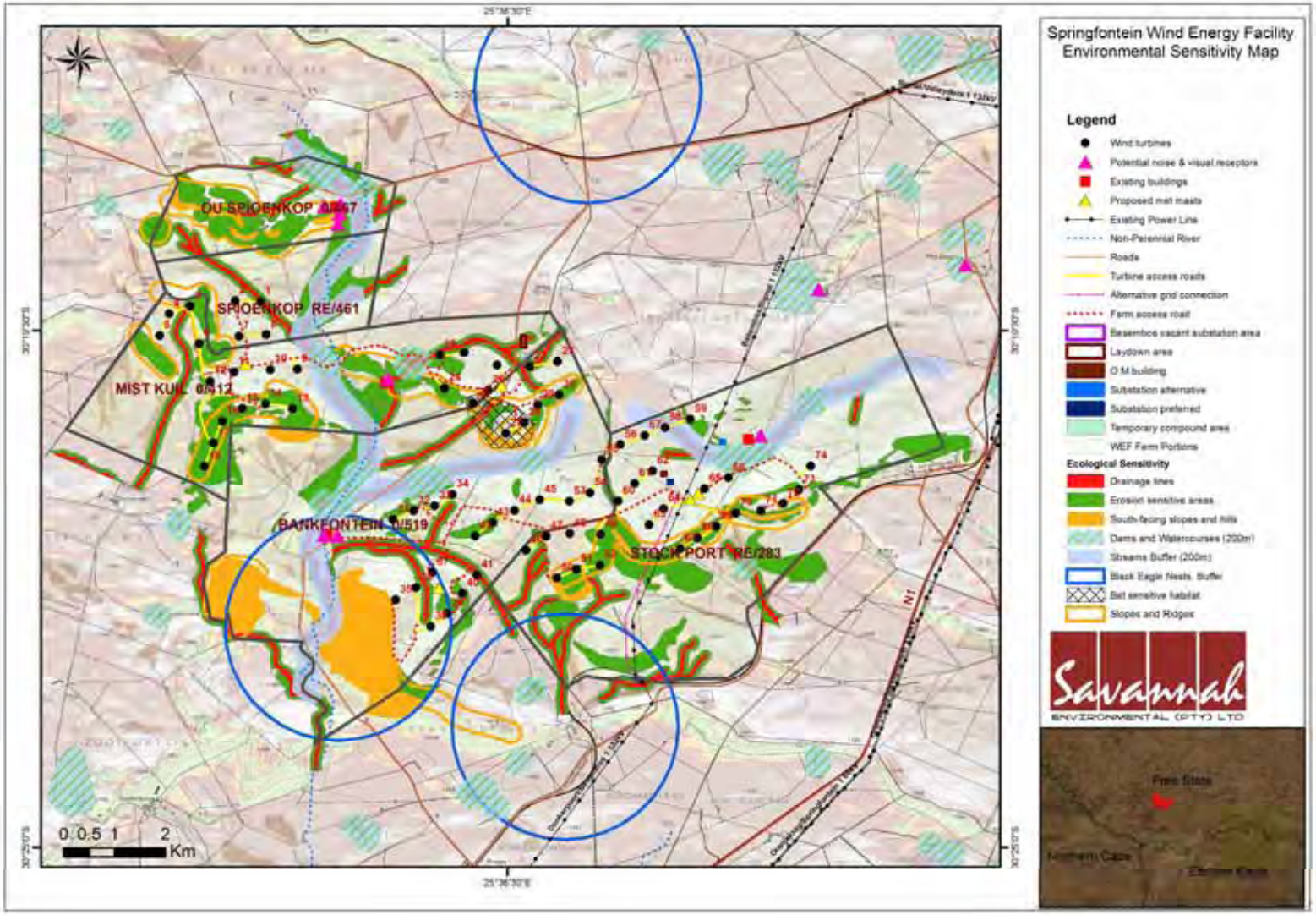

Figure 9.1: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Springfontein wind energy facility **(Appendix P contains A4 map)**

9.5.1 Micro-siting of turbines

Regarding the micro-sting of the wind turbines and associated infrastructure, from an ecological point of view, wind turbines which are within ecologically sensitive areas and whose locations should be adjusted/ shifted, includes the following turbines:

* Turbines 1, 3, 19, 22 and 41 are within minor drainage lines or areas which experience water flow during wet events and should be relocated adjacent to the drainage lines.
* Turbines 67, 68, 69, 70 are within or in close proximity to sensitive south-facing slopes and should also preferably be relocated, either off the slope or onto the north-facing slope.
* Turbines 25, 27 and 28 are located in areas of High Bat Sensitivity and should be moved to avoid the potential for bat collision with the wind turbines. 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 as having High Bat Sensitivity.

Figure 9.2 highlights (in red) these wind turbines that should be shifted. It is recommended that that the layout of the wind energy facility is revised to avoid these areas of environmental sensitivity identified during this environmental assessment. This revision of the layout can be done based on this assessment and by also considering technical aspects of the project.

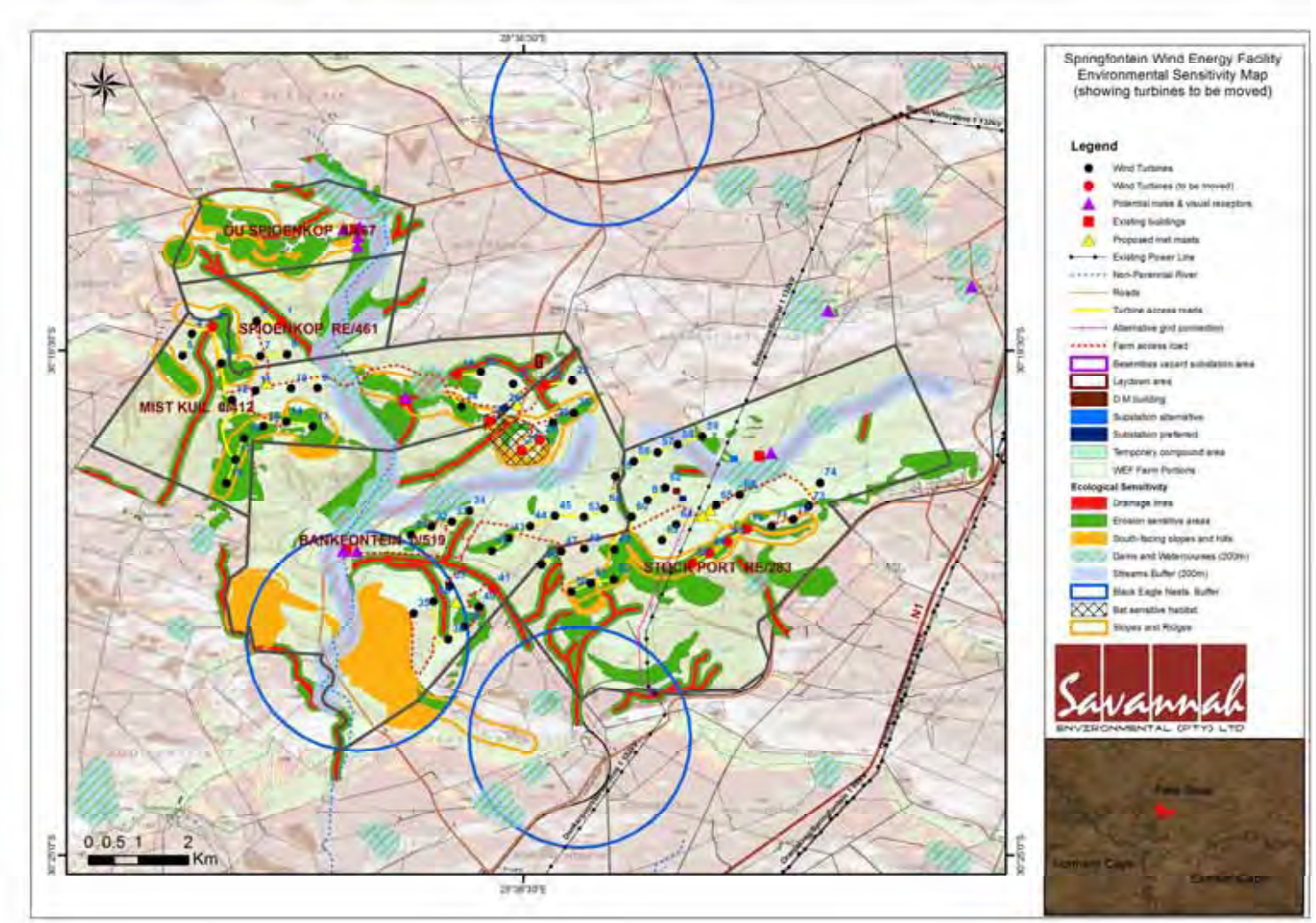

Figure 9.2: Map highlighting wind turbines (in red) that should be shifted

9.6. Overall Conclusion (Impact Statement)

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

Through pre-feasibility assessments and research, the viability of establishing the Springfontein Wind Energy Facility in the Free State has been established by Mainstream. The positive implications of establishing a wind energy facility on the demarcated site include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good coastal wind energy resources on this site would be realised.
» The National electricity grid in the Free State would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.
» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the

project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

9.7. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation and power line, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Springfontein wind energy facility and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

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

- The site is proposed to accommodate up to 74 wind turbines. The facility would be operated as a single facility with each turbine being between 1.4 MW and 4 MW in capacity. The capacity of the facility will be ~170MW
- Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 2m), a steel tower, a hub (between 80m and 120m above ground level) and a rotor and three blades.
- Internal/access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
- Workshop area / office for control, maintenance and storage (approximately 200m^2).
- An on-site substation to facilitate grid connection.
  - A 132 kV power line will connect the substation to the electricity distribution network/grid. The technically preferred Grid Connection Option is also preffered from an environmental point of view. The preferred grid connection option includes building a new 132 kV substation directly next to the existing Besembos-Signal 132kV line which traverses the site (on the Remaining Extent of Farm Stock Port 283). In order to connect the new on-site substation to the existing Besembos-Signal 132kV line a loop-in and loop out 132 kV power line of up to 500m in length, is proposed.
- Wind monitoring masts.

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

- » All mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.
- » The draft Environmental Management Programme (EMP) as contained within Appendix O of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- » Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- » A comprehensive search for threatened and near-threatened plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure if known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species. In terms of the NEM:BA a permit (A TOPS permit) is required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Free State Nature Conservation Ordinance.
- » The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas (if any) must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMP to be compiled for the project.
- » Bird and bat monitoring programmes that are underway on the site should continue in order to inform the final micro-siting of the wind turbines. Pre-construction bird and bat monitoring should continue to establish an adequate baseline for comparative purposes, in line with the last version of the bird and bat monitoring guidelines.
- » Plan the road and site layout in such a way as to make maximal use of existing roads and fence/border areas to minimise impacts and to keep grazing and natural units as intact as possible.

- Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- Establish an on-going monitoring programme to detect, quantify and remove any alien plant species that may become established.
- Adequate stormwater management measures to be put in place as the soils on the site are highly prone to erosion due to shallow profiles and steep slopes.
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
- Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMP).
- Applications for all other relevant and required permits if required to be obtained by Mainstream must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licence for abstraction of water from borehole/s, disturbance of protected vegetation, and disturbance to any water courses/ drainage lines.

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