PROPOSED KAROO RENEWABLE ENERGY FACILITY ON A SITE SOUTH OF VICTORIA WEST, NORTHERN AND WESTERN CAPE PROVINCE

CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PLAN FOR THE KAROO RENEWABLE ENERGY FACILITY

Submitted as part of the Final EIA Report
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

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

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

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 and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management 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 ongoing maintenance after implementation.

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

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur because 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 because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

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

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

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

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

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

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

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

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

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

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 100 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 speed: The rate at which air flows past a point above the earth's surface.

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PURPOSE AND OBJECTIVES OF THE EMP *CHAPTER 1*

An Environmental Management Plan (EMP) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"[1]. The objective of this EMP is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMP is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site remediation (soil stabilisation, revegetation) and operation.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed Karoo Renewable Energy Facility), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools for assisted use of the EMP by the project implementer as well as compliance monitors). The EMP is separated into measures dealing with the various project phases.

The EMP has the following objectives:

» To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the Renewable Energy Facility.

[1] Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

» To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
» To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
» To propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
» To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The mitigation measures identified within the EIA process are systematically addressed in the EMP, ensuring the minimisation of adverse environmental impacts to an acceptable level.

SARGE must ensure that the implementation of the project complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development and the implementation of the EMP through its integration into the contract documentation. Since this EMP is part of the EIA process undertaken for the proposed Karoo Renewable Energy Facility, it is important that this document be read in conjunction with the Scoping Report (December 2010) and EIA Report (April 2011), as well as the Environmental Authorisation (once issued). This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMP for construction and operation activities has been compiled in accordance with Section 34 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project.

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractor's obligations in this regard include the following:

» Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.

- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Providing basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.
- Ensuring awareness of any other environmental matters, which are deemed necessary by the Environmental Control Officer (ECO).

PROJECT DETAILS *CHAPTER 2*

SARGE is proposing to establish the Karoo Renewable Energy Facility and associated infrastructure on a site located approximately 34 km south of Victoria West in the Northern and Western Cape Province, within the Beaufort West and Ubuntu Local Municipalities. The larger site covers an area of approximately 202 km^2, which is larger than the development footprint for the facility.

The proposed facility will have a generating capacity of up to **500MW** and will comprise the following infrastructure:

» Up to 150[2] wind turbines with a generating capacity of up to 450MW;
» Each turbine will be a **steel tower** (between 80m and 125m in height), a **nacelle** (gear box) and three **rotor blades** with a rotor diameter of between 90m and 100 m (i.e. each blade ranging from 45 to 50m in length);
» An array of **photovoltaic (PV) panels** occupying an area of approximately 97 ha (including access roads) with a generating capacity of up to 50MW;
» Two (2) **132 kV substations** with high-voltage (HV) yard footprints of approximately 100m x 100m;
» **Foundations** to support both the turbine towers as well as the PV panels;
» **Cabling** between the project components, to be lain underground where practical;
» Two (2) new **overhead 132 kV power lines –**

From Substation 1:

- Substation 1 Option 1: To turn-in directly to the existing Hutchinson/Biesiespoort-1 132kV line (up to 1 km length of power line) or alternatively (Preferred)
- Substation 1 Option 2: To connect to Eskom's existing Biesiespoort Substation (up to 2.5 km length of power line).

From Substation 2:

- Substation 2 Option 1: To turn-in directly to the existing Droerivier/Hydra-2 400kV line (up to 1.5 km length of power line) or alternatively (Preferred)
- Substation 2 Option 2: To connect to Eskom's existing Victoria Substation (up to 12 km length of power line).

» **Internal access roads** (5 m wide and 82.15 km long) linking the wind turbines and PV component with the other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of a number of new internal access roads; and

[2] The current layout comprises 113 wind turbines. The EIA application remains for a facility of up to 150 wind turbines.

» **Small office and/or workshop building** (40m x 20m) for maintenance and storage purposes.

The facility is proposed on the following farm portions (refer to Figure 2.1):
» Remaining extent and Portion 3 of the Farm Nobelsfontein 227
» Remaining extent and Portion 1 of the Farm Annex Noblesfontein 234
» Portions 2, 3 and 4 of the Farm Ezelsfontein 235
» Remaining extent of the Farm Modderfontein 228
» Portion 1 of the Farm Rietkloofplaaten 239
» PhaisantKraal 1.

The EMP has been developed based on the findings of the EIA, and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

Areas of high ecological, avifaunal and visual sensitivity as well as areas of medium heritage sensitivity have been identified within the proposed development site. These include the following, and are demarcated on Figure 2.2:

» The only ecological impact of potentially high significance is that of the internal access roads on drainage lines. Due to the linear nature of access roads and the number of drainage lines across the site, there is the potential for a high number of drainage line crossings. If these are crossed in such a way as to significantly affect hydrological processes, then the impact will be of high significance. Mitigation measures can, however, reduce the significance to moderate.

» High sensitivity avifaunal areas have been identified during the avifaunal assessment and are deemed 'no-go' areas (Figure 6.3). These include cliff lines or elevated ridges as well as Verreaux's Eagle and Martial Eagle nest sites. These high sensitivity areas should be the focus of a pre-construction monitoring programme.

» Rock paintings, rock engravings, stone artefacts, stone walling as well as human remains were encountered on the site. A medium sensitivity has been ascribed to these heritage features.

» Tall hills and mountains are present within the boundaries of the study site. These steep slope faces have an elevated nature and inherent scenic quality, rendering them visually sensitive.

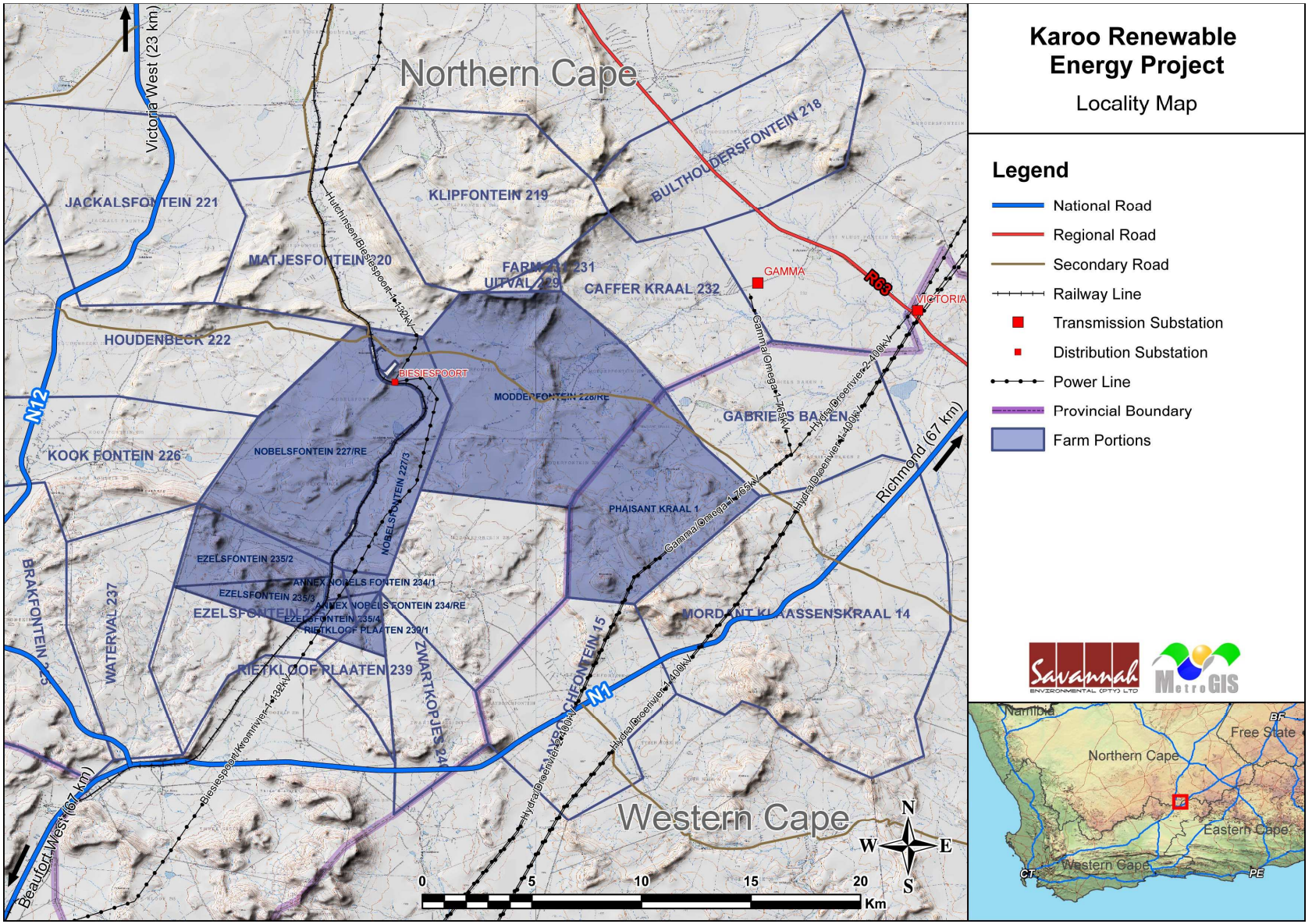

Figure 2.1: Locality map showing the site for project development.

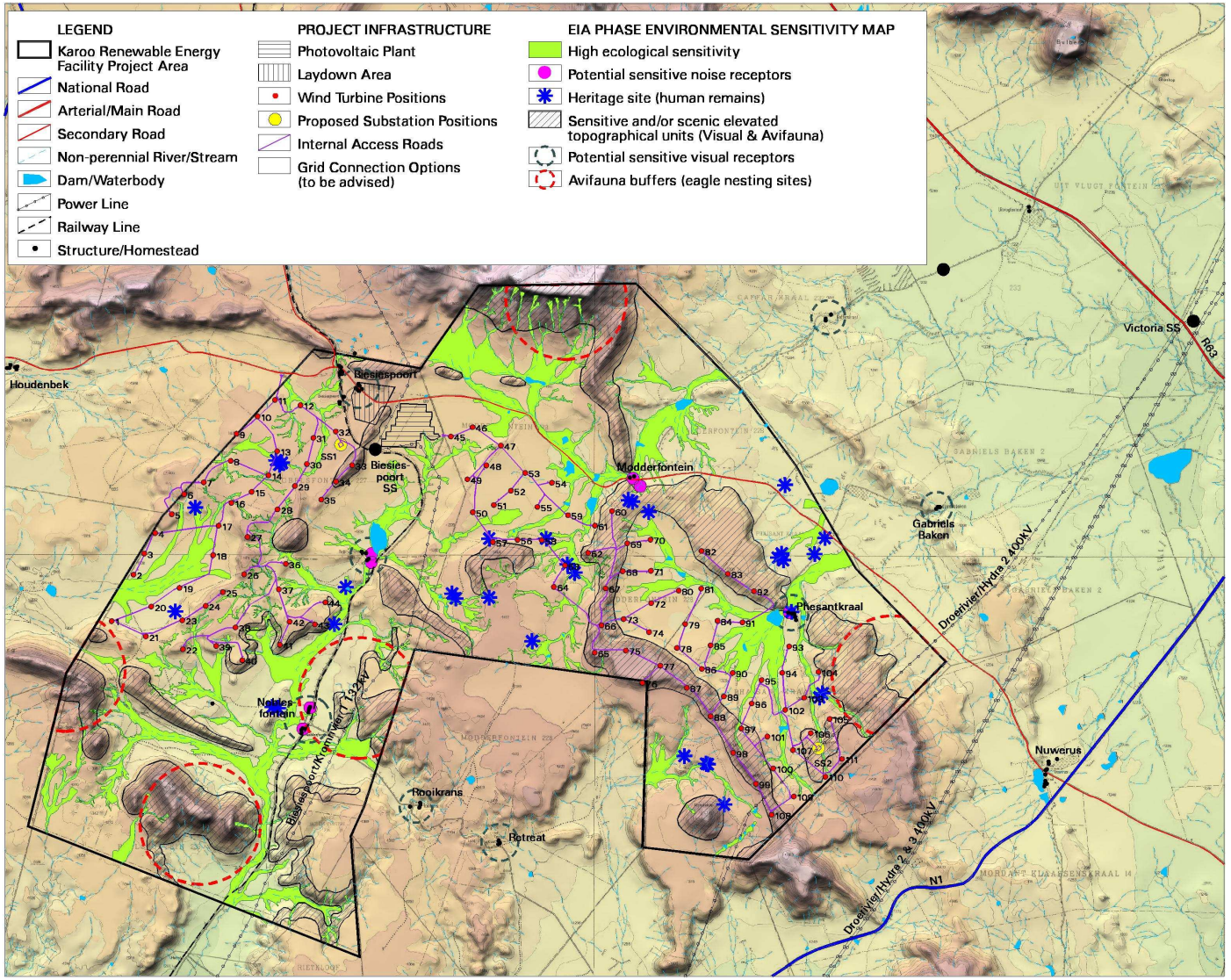

Figure 2.2: Revised sensitivity map for the Karoo Renewable Energy Facility site showing areas of high ecological, avifauna, heritage and visual sites, and sensitive noise receptors. This map indicates the revised infrastructure layout which takes ecological sensitivities identified during the EIA Phase into account (A3 map included in Appendix O of the Final EIA report).

2.1 Activities and Components associated with the Facility

The main activities/components associated with the Karoo Renewable Energy Facility are detailed in Table 2.1.

Table 2.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity/Project Component	Components of Activity	Details
	Planning	
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey and confirmation of the infrastructure micro-siting footprint; » Survey of substation sites; and » Survey of power line servitudes to determine tower locations.	» All surveys are to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). Establish internal access roads: 5 m wide and 82.15 km long permanent roadway within the site between the turbines and solar panels for use during construction and operation phase. » Temporary track of 5 m wide and 5.6 km long for use during construction phase only.	» Access roads will be constructed/upgraded in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. » Existing access roads to the site will be utilised, and upgraded where required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines and solar array (as well as specialist surveys). To accommodate the large crawler crane required for turbine assembly, a track of up to 11 m in width is required to be established on the site (as advised to be required by SARGE).

Main Activity/Project Component	Components of Activity	Details
Undertake site preparation	» Site establishment of offices / workshop with ablutions and stores, contractors yards » Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the footprint of each turbine and foundations for solar array » Excavations for foundations	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.
Establishment of lay down areas on site	» Lay down areas (temporary footprint 50 m x 25 m) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area for crane assembly.	» Each turbine needs a flat and hardened lay down area of up to 50 m x 25 m during the construction process. » This area can be rehabilitated after construction. » The lay down area will need to accommodate the cranes required in tower/turbine assembly. Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. A large lay down area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations of approximately of up to 15 m x 15 m x 2.5 m depth at each turbine location (final dimensions to be defined by geotechnical survey of the site).	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities.
Construct solar array foundations	» Concrete foundations supporting the	» Foundation holes will be mechanically excavated.

Main Activity/Project Component	Components of Activity	Details
	solar array (final dimensions to be defined by geotechnical survey of the site).	» Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities.
Transport of components and equipment to site	» Flatbed trucks will be used to transport the majority of components to site. Rail transport will also be used for the smaller components associated with the PV component: * Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades (each of up to 55 m in length). * The components required for the establishment of the PV panels. * Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and main lift crawler crane) to erect the wind turbines. * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment etc.). * The components required for the establishment of the substations (including transformers) * Components required for the	» Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines. Other components include components required for the establishment of the substations (including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine, including tower, will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.), and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. » The PV panels will be transported to site as assembled units while the support structures will be assembled once delivered to the site.

Main Activity/Project Component	Components of Activity	Details
	establishment of the power lines (including towers and cabling) * Ready-mix cement trucks for turbine, solar array and substation foundations	
Erect turbines and PV panels	» Large lifting crane used for lifting of large, heavy components » A small crane for the assembly of the rotor and possibly the PV panels	» The large lifting crane will lift the tower sections into place. » The nacelle, which contains the gearbox, generator, and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground. It will then be lifted to the nacelle and bolted in place. » It will take approximately 2 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor. » The steel support structures for the PV panels can be manufactured in South Africa and pre-drilled before being assembled on site.
Construct substations and associated ancillary infrastructure.	» Substations and associated components; » Security fencing around high-voltage (HV) yard; and » An operations and maintenance facility, including a workshop building, is proposed. Some of the existing on-site buildings may be utilised where practical.	» A temporary construction area is needed for containers, toilets, and equipment. » Permanent operational buildings are as follows: * Operations and maintenance facility, including a storage building (40 m x 20 m), will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. » A laydown area (66 ha) for building materials and equipment associated with these buildings will also be required. » The on-site substations will be constructed with a HV yard footprint of up to 100 m x 100 m. » The substations would be constructed as follows:

Main Activity/Project Component	Components of Activity	Details
		* Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of the solar array and wind turbines to the on-site substations	» Wind turbines » Solar PV panels » 33 kV underground (where practical) electrical cabling connecting each turbine as well as the solar array to the substations.	» The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables would follow the internal access roads as far as reasonably possible.
Connect substations to power grid	» Two new 132kV overhead power lines feeding into the power grid: ***From Substation 1:*** • Substation 1 Option 1: To turn-in directly to the existing Hutchinson/Biesiespoort-1 132kV line (up to 1 km length of power line) or alternatively **(Preferred)** • Substation 1 Option 2: To connect to Eskom's existing Biesiespoort Substation (up to 2.5 km length of power line). ***From Substation 2:*** • Substation 2 Option 1: To turn-in	» The route for the power lines will be assessed, surveyed, and pegged prior to construction. » A servitude of approximately 32 m will be required for each of the power lines.

Main Activity/Project Component	Components of Activity	Details
	directly to the existing Droerivier/Hydra-2 400kV line (up to 1.5 km length of power line) or alternatively **(Preferred)** • Substation 2 Option 2: To connect to Eskom's existing Victoria Substation (up to 12 km length of power line).	
Commissioning of the facility	» Renewable Energy Facility commissioning	» Prior to the start up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Similar checks will be undertaken for the PV panels before commissioning. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and solar array performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site remediation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
	Operation	
Operation	» Operation of the solar array » Operation of the wind turbines	» Once operational, the Renewable Energy Facility will be monitored remotely. » No permanent staff will be required on site for any extended period. It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather

Main Activity/Project Component	Components of Activity	Details
		conditions, or maintenance activities. » The solar array will be permanently operational except during circumstances of breakdown, extreme weather conditions, or maintenance activities.
Maintenance	Maintenance activities include: » Oil and grease – turbines; » Transformer oil – substation; and » Waste product disposal » Cleaning of PV panels (4 times per year) » Cleaning of turbines	» The wind turbines will be subject to periodic maintenance and inspection. » Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » PV panels will require approximately 1.5 litres of water per panel for cleaning. » The turbine and PV infrastructure is expected to have a lifespan of approximately 25 - 30 years, with maintenance.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform) » Mobilisation of construction equipment	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the PV panels/turbines with more appropriate technology/infrastructure available at that time.
Disassemble PV panels and wind turbines	» A large crane will be used to disassemble the turbine and tower sections. » The panels will be disassembled and removed.	» Turbine components would be reused, recycled, or disposed of in accordance with regulatory requirements. » The PV components will be disassembled, removed and then reused and recycled (where possible) or disposed of in accordance with regulatory requirements.

STRUCTURE OF THIS EMP *CHAPTER 3*

The first two chapters provide background to the EMP and the proposed project. The chapters which follow consider the:

» Planning and design activities
» Construction activities
» Operation activities
» Decommissioning activities

These chapters set out the procedures necessary for SARGE to achieve environmental compliance. For each of the phases of implementation for the renewable energy facility project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management programme has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions monitoring requirements and performance indicators. A specific environmental management programme table has been established for each environmental objective. The information provided within the EMP table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary in order to meet the overall goals; these take into account the findings of the environmental impact assessment specialist studies

Project component/s	List of project components affecting the objective, i.e.: » Wind turbines » PV panels » Access roads » Substations » Power lines
Potential Impact	Brief description of potential environmental impact if objective is not met
Activity/risk source	Description of activities which could impact on achieving objective
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion

Mitigation: Action/control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures	Time periods for implementation of

		measures

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management plan.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting

The objectives and EMP tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components and/or layout of the facility).
» Modification to or addition to environmental objectives and targets.
» Relevant legal or other requirements are changed or introduced.
» Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

3.1. Project Team

This EMP was compiled by:

	Name	**Company**
EMP Compilers:	Gerhard Cronje	Savannah Environmental
	Karen Jodas	Savannah Environmental
Specialists:	David Hoare - ecology	David Hoare Consulting
	Celeste Booth - heritage	Albany Museum
	Andrew Jenkins - ornithology	Avisense Consulting
	Iain Paton - soils and erosion	Outeniqua Geotechnical Services cc
	Morne de Jager – noise	MENCO (M2 Environmental Connections)
	Lourens du Plessis - visual	MetroGIS
	Ingrid Snyman - social	Batho Earth
	Lloyd Rossouw - Palaeontology	Lloyd Rossouw

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes for more than ten (10) years. They have managed and drafted Environmental Management Plans for other power generation projects throughout South Africa, including numerous wind and solar energy facilities.

MANAGEMENT PLAN FOR THE RENEWABLE ENERGY FACILITY: CHAPTER 4 PLANNING & DESIGN

4.1. Goal for Planning and Design

Overall Goal for Planning and Design: Undertake the planning and design phase of the Renewable Energy Facility in a way that:

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the project.
» Enables the Renewable Energy Facility construction activities to be undertaken without significant disruption to other land uses in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

4.2. Objectives

OBJECTIVE: To ensure that the design of the facility responds to the identified environmental constraints and opportunities

From the specialist investigations undertaken for the proposed Karoo Renewable Energy Facility development site, areas of high sensitivity were identified (refer to Figure 2.2).

The only ecological impact of potentially high significance is that of the internal access roads on drainage lines. Due to the linear nature of access roads and the number of drainage lines across the site, there is the potential for a high number of drainage line crossings. If these are crossed in such a way as to significantly affect hydrological processes, then the impact will be of high significance. Mitigation measures can, however, reduce the significance to moderate.

High sensitivity avifaunal areas have been identified during the avifaunal assessment and are deemed 'no-go' areas (Figure 6.3). These include cliff lines or elevated ridges as well as Verreaux's Eagle and Martial Eagle nest sites. These high sensitivity areas should be the focus of a pre-construction monitoring programme. The final chapter of

the Draft EIA Report included a recommendation that the location of Substation 2 (which is located towards the south eastern boundary of the study site) be shifted as this substation was located within the buffer zone of an avifaunal exclusion area (i.e. to avoid a nesting site of a Verreaux's Eagle). The new location of this substation does not infringe on the buffer zone around the nesting site of the Verreaux Eagle. SARGE has taken cognisance of this recommendation and has revised the location of Substation 2 by moving the substation clear of the sensitive nesting site and recommended buffer area around this site (refer to Figure 7.3 in the Final EIA report).

Substation 1 to the north of the site has been shifted 2 km south west of the original position to allow for improved connectivity of both the wind and solar components of the project (i.e. a stable connection directly to the Hutchinson/Biesiespoort-1 132kV line or the Biesiespoort Substation). The new substation position avoids all sensitive areas, minimises the distance of cabling required to connect the infrastructure to the substation, and reduces the power line length to connect to the Biesiespoort Substation from 2.5 km to 800m. Although the relocation of this substation is based primarily on technical factors, it has a positive effect by reducing the potential for environmental impact.

It was also recommended that the perennial and non-perennial rivers, streams and drainage lines present on-site (which are deemed sensitive) should be avoided as far as possible. Due to the linear nature of the road infrastructure it is almost impossible to avoid all drainage lines completely. Therefore, the internal road layout for the proposed facility has now followed the principles of a) making use of existing access roads, where possible, and b) minimising the number of drainage line crossings required.

Rock paintings, rock engravings, stone artefacts, stone walling as well as human remains were encountered on the site. A medium sensitivity has been ascribed to these heritage features.

Tall hills and mountains are present within the boundaries of the study site. These steep slope faces have an elevated nature and inherent scenic quality, rendering them visually sensitive.

Project component/s	Project components affecting the objective: » Wind turbines » Solar array » Access roads » Substations » Power lines
Potential Impact	» Design fails to respond optimally to the identified environmental considerations
Activities/risk	» Positioning of turbines and access roads

sources	» Positioning of solar array » Positioning of substations » Alignment of power lines
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, ecology, avifauna, and heritage sites, as detailed within the EIA report and relevant appendices.	Engineering Design Consultant / turbine supplier SARGE	Tender design, design review stage
Access roads to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil.	Engineering Design Consultant / turbine supplier and SARGE	Design phase
Of particular concern are 3 turbines located in a particularly elevated position (i.e. on top of a landform more than 140m above the surrounding area) and 5 turbines located on slopes in excess of 18 degrees. The 8 turbines of concern should be repositioned to lower lying areas and more moderate slopes.	SARGE	Design phase
Should the layout (or type of wind turbines used) change significantly during the final design, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.	SARGE	Design phase
A monitoring programme should be implemented to document the effect of the wind turbines on birds. This should take place before construction (to provide a benchmark), and continue during construction and during operation. The monitoring protocols as required by the EIA report for avifauna should be implemented.	SARGE in consultation with relevant Specialist	Pre-construction, construction, operation
Use bird-friendly power line tower and conductor designs.	SARGE	Design phase
Minimise the length of any new power lines installed as far as possible.	SARGE	Design phase
A detailed geotechnical investigation is required for the design phase for all infrastructure components.	SARGE	Design phase
Compile a comprehensive stormwater management plan for hard/compacted surfaces (e.g. substation footprints) as part of the final design of the project.	SARGE	Design phase
Identify construction areas and restrict construction	ECO/Contractor	Pre-construction,

Mitigation: Action/control	Responsibility	Timeframe
activity to these areas		construction
Undertake pre-construction heritage survey of the power line alignment to determine if any adjustments are necessary to mitigate impacts on heritage resources.	Relevant Specialists	Design stage - once layout is finalised
No construction activities may take place within 100m of the documented rock shelters containing rock paintings and boulders containing rock engravings.	Relevant Specialists	Design & Pre-construction
The ridges and rocky outcrops surrounding the locations of the turbines and solar panels must be investigated prior to construction to establish whether undocumented rock shelters contain rock paintings and rocky outcrops contain boulders with rock engravings. If any are encountered, no construction activities may take place within 100m of these.	Relevant Specialists, SARGE ECO/Contractor	Design phase
No construction activities may take place within 100m of the documented stone-wall structures.	Relevant Specialists SARGE ECO/Contractor	Design phase
If it is inevitable that construction activities must take place within 100m of any documented and undocumented rock shelters containing paintings, rocky outcrops with boulders containing rock engravings and stone-wall structures, then a perimeter fence must erected to protect the sensitive area from any possible negative impact.	Relevant Specialists SARGE ECO/Contractor	Design phase
If it is inevitable that construction activities must take place within 100m of any documented and undocumented rock shelters containing paintings, rocky outcrops with boulders containing rock engravings and stone-wall structures, then a perimeter fence must erected to protect the sensitive area from any possible negative impact.	Relevant Specialists SARGE ECO/Contractor	Design phase
It is possible that in situ archaeological sites/remains, and human remains may be uncovered during construction. Therefore, a professional archaeologist should be appointed during the vegetation removal and construction phases of the development.	Relevant Specialists SARGE ECO/Contractor	Design phase
Development should be excluded from areas within 500 m of any cliff lines or elevated ridges within the development area to reduce collision risk, primarily for slope soaring raptors.	SARGE in consultation with relevant Specialist	Design phase
Development should be excluded from areas within 1500 m of any known or suspected Verreaux's Eagle nest sites to reduce disturbance and collision risk for this species.	SARGE in consultation with relevant Specialist	Design phase

Mitigation: Action/control	Responsibility	Timeframe
Development should be excluded from areas within 2500 m of any known or suspected Martial Eagle nest sites to reduce disturbance and collision risk for this species.	SARGE in consultation with relevant Specialist	Design phase
Make use of existing roads where possible	Relevant Specialists SARGE ECO/Contractor	Design phase

Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, and Environmental Control Officer (ECO) prior to the commencement of construction.

Performance Indicator	» Power line alignments meet environmental objectives. » Substation sites and turbine/solar array layout minimises any negative environmental impacts and maximises any benefits.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, and the ECO prior to the commencement of construction.

OBJECTIVE: Initiate Bird Monitoring Programme

A monitoring programme should be implemented by SARGE (in consultation with an avifauna specialist) to establish population sizes and any migration routes, and to determine risk of collisions based on flight behaviour and patterns. This should take place before construction (to provide a benchmark), during construction and during operation. This is seen as critical to furthering the understanding of avifaunal impacts and renewable energy facilities on the site and in South Africa. Further details are included in Appendix A of this EMP.

Project component/s	List of project components affecting the objective » Power lines » Wind turbines » PV panels
Potential Impact	» Mortality of birds due to collision with turbines, PV panels and power line infrastructure.
Activity/risk source	» Turbines, PV panels and power infrastructure

Mitigation: Target/Objective	» The delivery of an effective impact mitigation scheme for the facility, informed initially by influence of pre-construction monitoring on final construction plans, and refined by post-construction monitoring of actual impacts, and resulting adjustments in management practices and mitigation measures applied.

Mitigation: Action/control	Responsibility	Timeframe
Appoint advising consultant/s to design pre- and post-construction monitoring.	SARGE Environmental consultant	Pre-construction
Implement monitoring programme.	Monitoring Agent/consultant	1 year before construction is due to start Pre-construction, construction, operation
Periodically collate and analyse pre-construction monitoring data. Review report on the full year of pre-construction monitoring, and integrate findings into construction EMP and broader mitigation scheme.	Advising avifauna consultant	Pre-construction, construction, operation
Refine monitoring protocol and determine the extent of radar deployment, if required.	Advising avifauna consultant	Pre construction

Performance Indicator	» Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and the proposed/operating renewable energy facility » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from pre-construction to operational phase » Quantifiable reductions in avian impacts once the facility is operational
Monitoring	» 3-monthly and annual reports produced by the scientist advising the monitoring project.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Karoo Renewable Energy Facility.

Substation 1 to the north of the site has been shifted 2 km south west of the original position to allow for improved connectivity of both the wind and solar components of the project (i.e. a stable connection directly to the Hutchinson/Biesiespoort-1 132kV line or the Biesiespoort Substation). The new substation position avoids all sensitive areas, minimises the distance of cabling required to connect the infrastructure to the substation, and reduces the power line length to connect to the Biesiespoort Substation

from 2.5 km to 800m. Although the relocation of this substation is based primarily on technical factors, it has a positive effect by reducing the potential for environmental impact.

Project component/s	» Wind Turbines » PV plant » Ancillary infrastructure (i.e. substations, power lines and access roads).
Potential Impact	» Primary visual impact of the core facility due to the presence of wind turbine structures, power lines and access roads in the landscape as well as the visual impact of shadow flicker and lighting at night.
Activity/risk source	» The viewing of the above mentioned by observers on or near the site as well as within the region.
Mitigation: Target/Objective	» Optimal placement of turbines and planning of infrastructure so as to minimise visual impact.

Mitigation: Action/control	Responsibility	Timeframe
Of particular concern are 3 turbines located in a particularly elevated position (i.e. on top of a landform more than 140m above the surrounding area) and 5 turbines located on slopes in excess of 18 degrees. The 8 turbines of concern should be repositioned to lower lying areas and more moderate slopes.	SARGE/design consultant	Planning.
Relocate turbines located within 500m of any inhabited settlement, homestead or public road to beyond this distance.	SARGE/design consultant	Planning.
Implement power line option 1 for both Substation 1 and Substation 2	SARGE/design consultant	Planning.
Plan internal access roads with due cognisance of the topography.	SARGE/design consultant	Planning.
Consult a lighting engineer in the planning and placement of light fixtures for the turbines, the PV plant and the ancillary infrastructure.	SARGE/design consultant	Planning.

Performance Indicator	» Additional power line infrastructure is minimal and hardly visible, and no internal access roads are visible from surrounding areas. Lighting impact is minimal and no shadow

	flicker impact. » Turbine positions in areas of steep slopes have been relocated
Monitoring	» Not applicable.

MANAGEMENT PLAN FOR RENEWABLE ENERGY FACILITY: CHAPTER 5 CONSTRUCTION

5.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the Renewable Energy Facility in a way that:

» Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
» Enables the Renewable Energy Facility construction activities to be undertaken without significant disruption to other land uses in the area, in particular concerning noise impacts, traffic and road use, and effects on local residents.
» Minimises the impact on the vegetation and habitat value of the site and where possible adds to the botanical record of this area.
» Minimises the impact on the archaeological and historical value of the site and where possible adds to the archaeological record of this area.
» Minimises impacts on birds and other fauna using the site.
» Establishes an environmental baseline during construction activities on the site, where possible, particularly with regard to priority bird species using the site.

5.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Site establishment and securing the site

Site establishment is the first activity which is to be undertaken within the construction phase. The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans and any other relevant local languages, all to the approval of the Project Manager.

Project component/s	Project components affecting the objective: » Wind turbines » Solar Array

	» Access roads » Substations » Power Lines
Potential Impact	» Hazards to public » Security of materials » Substantially increased damage to natural vegetation
Activities/risk sources	» Open excavations (foundations and cable trenches) » Movement of construction vehicles in the area and on-site
Mitigation: Target/Objective	» To secure the site against unauthorised entry » To protect members of the public/landowners/residents » No loss of or damage to natural vegetation in areas outside immediate development footprint; measured monthly during duration of construction.

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the ECO.	Contractor ECO	Erection: during site establishment Maintenance: duration of contract
Where necessary to control access, fence and secure area and implement access control procedures.	Contractor	Erection: during site establishment Maintenance: duration of contract
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: duration of contract
Fence off development footprints in sensitive areas in order to minimise disturbance to adjacent sensitive areas and to ensure it is clear to contractors where disturbance is permitted.	ECO	Prior to any construction activity
Minimise vegetation clearance associated with site establishment activities	Contractor	Site establishment

Mitigation: Action/control	Responsibility	Timeframe
All development footprints for roads, buildings, underground cables, laydown areas and turbine/solar array footings should be appropriately fenced off and clearly indicated with flags and/or danger tape strips. There is to be no disturbance outside these demarcated areas.	Contractor	Erection: during site establishment Maintenance: duration of contract
Establish the necessary ablution facilities with chemical toilets. Provide adequate sanitary facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Erection: during site establishment Maintenance: duration of contract
Ablution or sanitary facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands or within a horizontal distance of less than 100 m, whichever is applicable	Contractor	During site establishment, construction, maintenance
Supply adequate waste collection bins at site where construction is being undertaken.	Contractor	Erection: during site establishment Maintenance: duration of contract within a particular area

Performance Indicator	» Minimimal vegetation clearance associated with site establishment activities » No unnecessary environmental impacts associated with site established » Site is secure and there is no unauthorised entry » No members of the public/ landowners injured
Monitoring	» An incident reporting system will be used to record non-conformances to the EMP » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of non-conformances recorded.

OBJECTIVE: Control loss of indigenous natural vegetation

The study area is located within the Nama-Karoo Biome. The most recent and detailed description of the vegetation of this region is part of a national map which indicates three vegetation types occurring within the study site, namely Eastern Upper Karoo, Southern Karoo Riviere and Upper Karoo Hardeveld. These three vegetation types are described in more detail below.

Eastern Upper Karoo occurs on flats and gently sloping plains and is dominated by dwarf microphyllous shrubs with grasses from the genera Aristida and Eragrostis. There are some endemics in this vegetation, including the succulent shrubs. Southern Karoo Riviere is found on the narrow riverine flats in the southern parts of the Karoo, especially on heavier and salt-laden soils on broad alluvia. It consists of a complex of Acacia karroo thickets up to 5 m tall fringed by tall Salsola-dominated shrubland up to 1.5 m tall. Upper Karoo Hardeveld is found on steep slopes of koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation is a sparse dwarf Karoo scrub with drought tolerant grasses. There are a number of endemics in this vegetation, including succulent shrubs, low shrubs, tall shrubs, herbs and succulent herbs.

All three vegetation types occurring in the study area are classified as Least Threatened.

Project component/s	» Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	» Loss of indigenous natural vegetation due to construction activities
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities » Dumping or damage by construction equipment outside of demarcated construction areas.
Mitigation: Target/Objective	» Minimal loss of natural vegetation

Mitigation: Action/control	Responsibility	Timeframe
The construction impacts must be contained to the footprint of the infrastructure.	SARGE Contractor	Construction
Internal access roads and underground cables should be aligned as much as possible along existing linear disturbances, e.g. roads on site, or the edges of cultivated lands, and away from steep slopes and drainage lines as much as possible.	SARGE Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Unnecessary impacts on surrounding natural vegetation must be avoided.	SARGE Contractor	Construction
Rehabilitate any disturbed areas immediately to stabilise landscapes	SARGE Contractor	Construction

Performance Indicator	» No loss of natural vegetation within areas deemed as sensitive.
Monitoring	» None

OBJECTIVE: Limit damage to wetlands & watercourses

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

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.

It was also recommended that the perennial and non-perennial rivers, streams and drainage lines present on-site (which are deemed sensitive) should be avoided as far as possible. Due to the linear nature of the road infrastructure it is almost impossible to avoid all drainage lines completely. Therefore, the internal road layout for the proposed facility has now followed the principles of a) making use of existing access roads, where possible, and b) minimising the number of drainage line crossings required.

Project component/s	» Any infrastructure or activity that will result in disturbance to wetlands
Potential Impact	» Damage to wetland areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the watercourse as a natural system
Activity/risk source	» Site preparation and earthworks » Construction-related traffic

	» Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities » Dumping or damage by construction equipment outside of demarcated construction areas.
Mitigation: Target/Objective	» No unauthorised damage to wetlands or watercourses within project area

Mitigation: Action/control	**Responsibility**	**Timeframe**
Appoint an independent environmental control officer during construction and an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats	SARGE, Contractor, ECO	Construction, Operation
Obtain a permit from DWA to impact on any wetland or water resource.	SARGE, Contractor, ECO	Construction, Operation
For any new construction where impacts are unavoidable, cross watercourses perpendicularly to minimise disturbance footprints	SARGE, Contractor, ECO	Construction, Operation
Rehabilitate any disturbed areas as quickly as possible	SARGE, Contractor, ECO	Construction, Operation
Control stormwater and runoff water	SARGE, Contractor, ECO	Construction, Operation
Infrastructure (including culverts and/or bridges) should not be placed within drainage line channels but should span them completely.	SARGE, Contractor, ECO	Construction, Operation
Make use of existing access roads where possible	SARGE, Contractor, ECO	Construction, Operation

Performance Indicator	» No unauthorised impacts on water quality, water quantity, wetland riparian/vegetation, natural status of watercourses
Monitoring	» Habitat loss in watercourses should be monitored before and after construction. » The presence and development of erosion features downstream of any construction through wetlands must be monitored.\

OBJECTIVE: Control alien invasive plants

Project	» Any infrastructure or activity that will result in disturbance to natural

component/s	areas
Potential Impact	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activity/risk source	» Construction activities
Mitigation: Target/Objective	» No alien plants within project control area

Mitigation: Action/control	Responsibility	Timeframe
Avoid creating conditions in which alien plants may become established: a. keep disturbance of indigenous vegetation to a minimum b. rehabilitate disturbed areas as quickly as possible c. do not import soil from areas with alien plants	Contractor ECO	Construction
Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act)	Contractor ECO	Construction
Immediately control any alien plants that become established using registered control methods	Contractor ECO	Construction

Performance Indicator	» For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	» Ongoing monitoring of area by environmental control officer during construction » Ongoing monitoring of area by environmental manager during operation » Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework.

OBJECTIVE: Limit impacts on habitat of Riverine Rabbit

Project component/s	» Any infrastructure or activity that will result in disturbance to habitat suitable for the Critically Endangered Riverine Rabbit
Potential Impact	» Loss of habitat suitable for the Critically Endangered Riverine Rabbit
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities
Mitigation: Target/Objective	» No significant impacts on identified suitable habitat for the Riverine Rabbit within project control area

Mitigation: Action/control	**Responsibility**	**Timeframe**
Avoid impacts on riparian habitat identified as being suitable for the Riverine Rabbit. This species is found in riverine vegetation on alluvial soils adjacent to seasonal rivers.	SARGE, Contractor, ECO	Construction, Operation

Performance Indicator	» No loss of habitat suitable for the Riverine Rabbit
Monitoring	» Map extent of suitable habitat before construction. » Identify project components that infringe on habitat. » After construction, record any disturbance to habitat in terms of extent and potential effects on remaining habitat.

OBJECTIVE: A Renewable Energy Facility that is sustainable in terms of its impacts on local avifauna

The proposed facility could have a significant, long-term impact on the avifauna of the surrounding area. The proposed Karoo Renewable Energy Facility is located in an area on the fringes of a national Important Bird Area, known to support good populations of a number of threatened and/or endemic bird species, as well as high densities of other, ecologically valuable species. The proposed facility is likely to have a detrimental effect on these birds, during both the construction and operational phases of the development. The scale of the development renders these impacts potentially significant, and accentuates the need for full compliance with the stipulated mitigation and monitoring measures.

The worst affected taxa are likely to be large raptors (Verreaux's and Martial Eagles) nesting on existing transmission power line towers on the Karoo flats, or else on the cliffs of Gys Roosberg, the Horseshoe and some outlying ridge lines, and using these topographic features for slope soaring. Another possible impact of the facility will be displacement effects on, and collision mortality of Ludwig's Bustard and Blue Crane.

Pre- and post-construction monitoring will be vital to improve understanding of the risk posed by the REF on local bustards, and how best to mitigate this risk.

These effects may be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined, from pre-construction and into the operational phase of the project. Full clarity on the likely environmental impact of this facility can only be reached once pre-construction monitoring has been completed.

The final chapter of the Draft EIA Report included a recommendation that the location of Substation 2 (which is located towards the south eastern boundary of the study site) be shifted as this substation was located within the buffer zone of an avifaunal exclusion area (i.e. to avoid a nesting site of a Verreaux's Eagle). The new location of this substation does not infringe on the buffer zone around the nesting site of the Verreaux Eagle. SARGE has taken cognisance of this recommendation and has revised the location of Substation 2 by moving the substation clear of the sensitive nesting site and recommended buffer area around this site (refer to Figure 7.3).

Project component/s	» Wind turbines » Photovoltaic solar panels » Access roads » Substation linking the facility to the electricity grid » Underground cabling » Power lines
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades and PV array/s » Disturbance to or loss of birds as a result of collision with the overhead power lines » Electrocution on power line and substation
Activity/risk source	» Starting pre-construction monitoring too late » Appointment of unqualified personnel to do the monitoring » Results of pre-construction monitoring not integrated into the final layout and/or the mitigation scheme » Lack of clear communication between the scientist analysing the monitoring data and the client » Misinterpretation of either the pre- or post-construction monitoring data
Mitigation: Target/Objective	» No significant impacts on identified bird species of concern. » The delivery of an effective impact mitigation scheme for the facility, informed initially by influence of pre-construction monitoring on final construction plans, and refined by post-construction monitoring of actual impacts, and resulting adjustments in management practices and mitigation measures applied

Mitigation: Action/control	Responsibility	Timeframe
Appoint advising consultant/s to design pre- and post-construction monitoring.	SARGE Environmental consultant	Pre-construction
Implement monitoring programme.	Monitoring Agent/consultant	1 year before construction is due to start Pre-construction, construction, operation
Periodically collate and analyse pre-construction monitoring data. Review report on the full year of pre-construction monitoring, and integrate findings into construction EMP and broader mitigation scheme.	Advising avifauna consultant	Pre-construction, construction, operation
Refine monitoring protocol and determine the extent of radar deployment, if required.	Advising avifauna consultant	
Periodically collate an analyse pre-construction monitoring data	Advising scientist and radar specialist (if applicable)	Every 2-3 months of monitoring
Review report on the 6-12 months of pre-construction monitoring, and integrate findings into construction EMP and broader mitigation scheme	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	After a year of pre-construction monitoring
Ensure construction EMP is applied, with particular reference to minimising the temporary and permanent development footprint, and the extent and duration of noise and movement disturbance, and ensuring that stipulations re sensitive areas and times are adhered to.	Relevant Environmental Control Officer	During construction
Refine post-construction monitoring protocol in terms of results pre-construction, and determine the extent of radar deployment required	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	As soon as possible / practical after construction completed
Periodically collate and analyse post-construction monitoring data	Advising scientist and radar specialist (if applicable)	Every 2-3 months of monitoring
Review report on the full year of post-construction monitoring, and integrate findings into operational	Advising scientist, monitoring agency and	1 year post-

Mitigation: Action/control	Responsibility	Timeframe
EMP and broader mitigation scheme	radar specialist (if applicable), in negotiation with the client	construction
Review the need for further post-construction monitoring	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	1 year post-construction
Development should be excluded from areas within 500 m of any cliff lines or elevated ridges within the development area to reduce collision risk, primarily for slope soaring raptors.	SARGE & Contractor	Duration of construction
Development should be excluded from areas within 1500 m of any known or suspected Verreaux's Eagle nest sites to reduce disturbance and collision risk for this species.	SARGE & Contractor	Duration of construction
Development should be excluded from areas within 2500 m of any known or suspected Martial Eagle nest sites to reduce disturbance and collision risk for this species.	SARGE & Contractor	Duration of construction

Performance Indicator	» Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and the proposed/operating Renewable Energy Facility » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from pre-construction to operational phase » Quantifiable reductions in avian impacts once the facility is operational
Monitoring	» Map extent of suitable habitats for priory species before construction. » Identify project components that infringe on habitat and or longevity of species of concern. » After construction, record any disturbance to habitat in terms of extent and potential effects on remaining habitat.3-monthly and annual reports produced by the scientist advising the monitoring project

OBJECTIVE: To avoid and or minimise the potential risk of increased veld fires during the construction phase

Uncontrolled, unplanned fires will not serve their desired purpose and may serve to place the vegetation in the study area and the people on at risk of veld fires.

Project component/s	Construction and establishment activities associated with the Renewable Energy Facility and associated infrastructure
Potential Impact	Veld fires can pose a personal safety risk to local farmers and communities, and their homes, livestock and farm infrastructure, such as gates and fences.
Activities/risk sources	The presence of construction workers and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	SARGE & Contractor	Duration of construction
Provide adequate fire fighting equipment onsite.	SARGE & Contractor	Duration of construction
Provide fire-fighting training to selected construction staff.	Contractor	Duration of construction
Compensate farmers / community members at full market related replacement cost for any losses, such as livestock, damage to infrastructure etc for losses associated with fires resulting from negligence or non-compliance.	Contractor	As required

Performance Indicator	» Designated areas for fires identified on site at the outset of the construction phase. » Fire fighting equipment and training provided before the construction phase commences. » Compensation claims settled within 1 month of claim being verified by Community Monitoring Forum.
Monitoring	» SARGE and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Soil and rock degradation and erosion control

The natural geological profile including bedrock and soil cover must be preserved as far as possible to minimise unforeseen impacts on the surrounding environment.

A set of strict mitigation measures are required to effectively limit the impact on the geological environment. The proposed disturbance areas - where construction activity is likely to occur - are the focus of the mitigation measures laid out below.

Project component/s	» Wind turbines » Photovoltaic solar panels » Access roads » Substation linking the facility to the electricity grid » Underground cabling » Power lines
Potential Impact	» Soil and rock removal » Soil mixing, wetting, stockpiling, compaction » Soil pollution » Accelerated soil erosion » Increased deposition of soil into drainage systems » Increased run-off over the site » Dust pollution
Activities/risk sources	» Construction activity – earthworks & transportation across site » Machinery, chemicals and human waste – soil pollutants » Rainfall - water erosion of disturbed areas » Wind erosion of disturbed areas
Mitigation: Target/Objective	» To minimise size of construction disturbance areas » To minimise destructive activity within disturbance areas & prevent unnecessary activity outside of disturbance areas » To minimise soil degradation (removal, excavation, mixing, wetting, compaction, pollution, erosion, etc.) » To minimise deposition of soil into drainage lines » To minimise dust pollution

Mitigation: Action/control	Responsibility	Timeframe
Identify areas of high erosion risk (drainage lines/watercourses). Only special works to be undertaken in these areas to be authorised by ECO and Engineer's representative (ER)	ECO/ER/Contractor	Before and during construction
Identify disturbance areas for general construction work and restrict construction activity to these areas.	ECO/ER/Contractor	Before and during construction
Prevent unnecessary destructive activity within disturbance areas (prevent over-excavations and double handling)	ECO/ER/Contractor	Before and during construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary degradation of soil. Special attention to be given to roads that cross drainage lines and roads on steep slopes (to prevent unnecessary cutting and filling operations).	ECO/ER/Contractor	Before and during construction

Mitigation: Action/control	Responsibility	Timeframe
Dust control on construction site: Wetting or covering of cleared areas.	Contractor	During construction
Minimise removal of vegetation which aids soil stability.	ECO/Contractor	During construction
Rehabilitate disturbance areas as soon as an area is vacated.	Contractor	During and after construction
Soil conservation: Stockpile topsoil for re-use in rehabilitation phase. Protect stockpile from erosion.	Contractor	Before and during construction
Erosion control measures: Run-off control and attenuation on slopes (sand bags, logs), silt fences, stormwater channels and catch-pits, shade nets, soil binding, geofabrics, hydroseeding or mulching over cleared areas.	Contractor/ECO	Erection: Before construction Maintenance: Duration of contract
Where access roads cross natural drainage lines, culverts must be designed to allow free flow. Regular maintenance must be carried out	ECO/ER/Contractor	Before construction and maintenance over duration of contract
Control depth of excavations and stability of cut faces/sidewalls	ECO/ER/Contractor	Before construction and maintenance over duration of contract
Control stormwater and runoff water by means of establishing a comprehensive stormwater management plan for compacted surfaces	ECO/ER	Before and during construction

Performance Indicator	» Only authorised activity outside disturbance areas » No activity in no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of increased siltation in drainage lines, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by ER & ECO
Monitoring	» Fortnightly inspections of the site » Fortnightly inspections of sediment control devices » Fortnightly inspections of surroundings, including drainage lines » Immediate reporting of ineffective sediment control systems » An incident reporting system will record non-conformances

OBJECTIVE: Maximise local employment and business opportunities associated with the construction phase

Employment opportunities could be created during the construction phase although limited. The unemployment rate in the study area is quite high and there are therefore various individuals in the area in search of employment. As indicated it is foreseen that it would be possible to make use of local labour for sections of the construction activities. Opportunities for SMMEs to be considered for some of the construction activities also exist. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs.

Project component/s	Construction and establishment activities associated with the establishment of the facility and associated infrastructure such as the power line and substations.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	» Contractors who make use of their own labour thereby reducing the employment and business opportunities for locals. » The inflow of various specialists from outside the study area and even abroad » Sourcing of individuals outside the municipal area
Mitigation: Target/Objective	The project proponent should aim to employ a maximum number of the low-skilled to semi-skilled workers from the local area where possible. This should also be stipulated in the tender documentation and contractors should adhere to this guideline. Inputs from the Ubuntu Local Municipality in this regard would be critical.

Mitigation: Action/control	Responsibility	Timeframe
Employment of local community members (e.g. source labour from within the municipal area) should be undertaken where possible.	Project proponent, Ubuntu Local Municipality (ULM) & Contractor	Construction
A broad-based approach should be followed to identify and involve relevant organisations which could assist the main contractor and project proponent in identifying people whose skills may correspond with the job specifications	Project proponent, Ubuntu Local Municipality (ULM) & Contractor	Construction
An equitable process should be promoted whereby locals and previously disadvantaged individuals (women) are taken into account.	ULM & Project proponent	Construction
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the	ULM, Project proponent & Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
construction process.		
Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMME's from the local sector.	Project proponent & Contractor	Construction
A local labour desk should be set-up (if not already established) in the beneficiary communities to co-ordinate the process of involving local labour.	ULM & Contractor	Construction
Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.	Project proponent	Construction

Performance Indicator	» Job opportunities, especially of low to semi-skilled positions, are primarily awarded to members of local communities. » Locals and previously disadvantaged individuals (women) are taken into account during the hiring process. » SMME's are awarded with contracts during the construction phase. » Labour, entrepreneurs, businesses and SMME's from the local sector are awarded with jobs, based on requirements in the Tender Documentation. » The involvement of local labour is promoted. » Reports are not made from members of the local communities regarding unrealistic employment opportunities.
Monitoring	» Project proponent and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Address economic inequities within the study area and enhance capacity building and skills training

A concerning factor is the low education levels among the population of the Ubuntu and Beaufort West Local Municipalities and the fact that the majority of the people within the Ubuntu Local Municipality are employed within the agricultural sector and those in the Beaufort West Local Municipality are employed within the commerce, community services and agricultural sectors. It should, however be noted that a small number of the people of the Ubuntu Local Municipality are employed within the construction sector. As the construction phase would involve unskilled, semi-skilled and skilled workers it is likely that applicable locals for the unskilled and semi-skilled positions could be sourced and that there would be sufficient numbers of individuals to choose from.

Due to the high unemployed figures, it is also clear that there would be various unemployed persons in search of employment, even if they can only secure temporary positions. For the lower level skilled positions, outsiders would thus definitely not have to be sourced. Even though all that would be employed might not have the necessary applicable skills, this issue could be addressed through proper focused skills training and capacity building initiatives after locals have been sourced, but prior to construction activities starting.

Project component/s	Availability of required skills in the local communities
Potential Impact	The opportunities and benefits associated with the creation of local employment and business could be maximised as it is anticipated that sufficient locals would have the necessary skills to be employed.
Activity/risk source	Unavailability of locals with the required skills resulting in locals not being employed and labour be sourced from outside the ULM area Higher skilled positions might even be sourced internationally
Mitigation: Target/Objective	Project proponent, in discussions with the ULM, should aim to employ a maximum number of the low-skilled workers from the local area where possible. Should the necessary skills not be readily available, skills training and capacity building should be undertaken

Mitigation: Action/control	Responsibility	Timeframe
A broad-based approach should be followed to identify and involve relevant organisations in identifying people whose skills may correspond with the job specifications.	Project proponent and ULM	Construction
In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Project proponent and Contractor	Construction
Capacity building and skills development should include on-site training and tailor made individual packages to further each individual	Project proponent and Contractor	Construction
Capacity building initiatives could link in with existing capacity building and skills training initiatives of the ULM and/or other initiatives of contractors	Project proponent and ULM	Construction

Performance Indicator	» A skills development plan is developed » Job opportunities, especially of lower skilled positions, are primarily awarded to members of local communities. » Skills training and capacity building initiatives are developed and implemented » Local SMME's and/or entrepreneurs should be awarded the

	opportunity to become involved in the tender process.
Monitoring	» Project proponent and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Minimise the impact of the inflow of an outside workforce and job seekers into the study area

A total of twenty (20) construction workers would be involved with the project. The timeframe for the proposed PV facility would be between 12 to 18 months and for the wind energy facility it could be between 18 to 24 months. All construction workers are not expected to be on site for the entire duration of the construction period and the numbers would increase only during the peak construction times.

No construction workers would be housed on site and no construction camp for accommodation purposes would be built. Workers would thus have to be transported to and from site on a daily basis. The inflow of workers to and from the construction site could thus result in intrusion impacts (an increase in traffic, noise, dust, etc.) irrespective of whether locals or outsiders would be employed. This, however is anticipated to result in a limited negative impact.

Other possible negative impacts due to the workforce's presence in the area and especially when jobseekers come to the area would include misconduct of workers, trespassing of workers on privately owned farms, the possible increase in crime, littering, increase in traffic, increase in noise, the development of informal vending stations and so forth. Poaching of livestock is also a source of concern.

Project component/s	Inflow of an outside workforce and jobseekers
Potential Impact	The inflow of outsiders and jobseekers could result in negative impacts on the surrounding property owners and local communities, and could even lead to conflict between the locals and these outsiders.
Activity/risk source	Outside workforce and jobseekers come into conflict with locals, their presence leads to environmental pollution and possibility of them remaining in the area after construction has ceased. This would put additional pressure on the existing infrastructure and services. Locals are not employed, which would increase the probability of the impacts occurring.
Mitigation: Target/Objective	Limit the number of outsiders to be employed and put pro-active measures in place to deal with possible jobseekers. A transparent approach and open consultation with adjacent property owners, prior and throughout the construction period will further provide a

	platform where grievances or requests can be addressed before issues become contentious.

Mitigation: Action/control	Responsibility	Timeframe
Construction workers falling within the semi-skilled to unskilled category should be sourced from the local population where possible	Contractor	onstruction
Local labourers should remain at their existing residences and no workers can be allowed on site during night time. No workers should thus be accommodated on site at night.	Contractor	Construction
Maintain normal working hours. Where possible, on-site construction activities will be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays) (in terms of the Environment Conservation Act).	Contractor	Construction
Security on-site should be active during the construction period	Project proponent	Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Environmental Control Officer	Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce.	Project proponent	Construction
Sufficient water and sanitation facilities should be provided for the workers on site during the construction period.	Contractor	Construction
The construction site should be properly managed to avoid any environmental pollution (due to inadequate water and waste infrastructure and services) and littering.	Environmental Control Officer & Contractor	Construction
The construction site should be properly managed	Environmental Control Officer & Contractor	Construction
The construction site should be properly fenced	Contractors	Construction
The applicant, local leaders and the Ubuntu Local Municipality should jointly develop a strategy to minimise the influx of jobseekers to the area	Project proponent, local leaders and ULM	Construction
Informal vending stations should not be allowed on or near the construction site. Construction workers should preferably receive daily meals and beverages to avoid the need for a vending station.	Contractors	Construction
Information distributed as part of the existing	Project proponent &	Construction

Mitigation: Action/control	Responsibility	Timeframe
HIV/Aids awareness campaigns should again be focused on and communicated to the local workforce.	Contractors	
Develop a transparent communication and recruitment process to minimise the influx of jobseekers to the area.	Project proponent, local leaders and the ULM	Construction
The recruitment process and the use of contractors should be clearly communicated to the local communities.	Project proponent	Construction
The communication strategy should ensure that unrealistic employment expectations are not created.	Project proponent	Construction

Performance Indicator	» Locals are employed. » Reports are not made from members of the local communities regarding unrealistic employment opportunities and/or negative intrusions or even possible increase in crime. » Sound environmental management of construction site. » Limited numbers of jobseekers coming to the area. » No conflict between outsiders, jobseekers and local community members
Monitoring	» Project proponent and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise traffic related impacts

Access to the farms under investigation can be obtained from the N1 and N12, as well as a secondary road, referred herein as the Biesiespoort Road leading to the actual site itself. The R63 is to the north west of the proposed site. Some additional smaller "farm roads" which are normally only used by residents of the surrounding area to access their properties link from these roads. The imported wind turbines would be transported via sea to possibly Cape Town harbour where after it would be transported along the national, secondary and local access roads to the actual site. It is proposed that some of the smaller components of the facility could be transported via rail to the station located on site. Due to the size of the wind turbines and the abnormal size of the vehicles that would be required, some of the secondary and local roads would have to be upgraded prior to the delivery of the turbines, which would include widening of

corners and/or bridges. Abnormal vehicles would have the most detrimental impact on the local roads' surface and capacity. Additional construction vehicles that would make use of the national, secondary and local roads to access the construction site(s) would include cranes, trucks, excavators, graders and those heavy vehicles transporting the materials and equipment required for especially the wind component of the proposed facility. Even though the N12 is being upgraded, all of these types of vehicles would thus increase the risk of accidents on these roads and would put additional pressure on the capacity and road surface of the local gravel roads.

Project component/s	Traffic related impacts on existing road infrastructure and property owners situated along the routes to be travelled and those surrounding the construction site, as well as possible impact on local road users.
Potential Impact	Impact of abnormal sized vehicles and general heavy construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals
Activities/risk sources	Construction vehicle movement Speeding on local roads Degradation of local road conditions
Mitigation: Target/Objective	Minimise the impact of the increase in abnormal and heavy vehicles on existing infrastructure, property owners, animals and road users.

Mitigation: Action/control	Responsibility	Timeframe
The contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified with affected parties prior to the construction phase.	SARGE and Environmental Control Officer	Pre-Construction
All regulations and legislation pertaining to the use of provincial and local roads by abnormal vehicles to transport the wind turbines should be noted and adhered to	SARGE, Contractor and relevant government departments (national and provincial)	Pre-construction Construction
Speeding of construction vehicles should be avoided at all costs	Contractor & Environmental Control Officer	Construction
Strict vehicle safety standards should be implemented and monitored	Contractor & Environmental Control Officer	Construction
Property owners of the surrounding farms should at all times have proper access to their properties	Contractor & Environmental Control Officer	Construction
The local gravel access roads frequently used by construction vehicles should regularly be graded by the project proponent to limit the degradation of the road surface	SARGE	Construction

Performance Indicator	» Vehicles keeping to the speed limits » Vehicles are in good working order and safety standards are implemented » Local residents and road users are aware of vehicle movements and schedules » Property owners have access to their properties at all times. » No traffic related accidents are experienced. » Local road conditions and road surfaces are up to standard » Complaints of residents are not received (e.g. with regards to the speeding of heavy vehicles).
Monitoring	» SARGE and/or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise the potential impact on safety and security

An inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities. The actual safety of construction workers is also of concern due to the large equipment used and the size of the turbines to be erected. Further health and safety issues associated with the actual construction site include unauthorised entry to the site and construction areas, the usage of large cranes on site, the risks associated with the storage of equipment and material on site, as well as the increased risk of accidents due to the increased movement of construction vehicles on the local roads.

Other concerns relate to littering, unwanted behaviour of construction workers, transmission of Sexually Transmitted Diseases (STDs), environmental pollution, an increase risk in fires and so forth. Although such perceptions cannot be substantiated or be changed it should be sensitively dealt with. It is thus clear that even though the construction phase when these impacts could occur is only of a very short to short duration, the effects of the impacts could remain in the medium term.

Project component/s	Inflow of workers could result in increased safety and security risks.
Potential Impact	Outside workers are involved in criminal activities and/or fires occur.
Activities/risk sources	» Safety of individuals and animals are at risk » Theft of livestock » Theft of construction material » On-site accidents » Spread of sexually transmitted diseases

	» Littering and environmental pollution
Mitigation: Target/Objective	Employment of local labour should be maximised and strict security measures should be implemented at the construction site.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the presence of an outside workforce.	Contractor	Pre-Construction
Screening of workers that apply for work could be useful to lessen perceived negative perceptions about the outside workforce.	Contractor	Pre-Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Contractor	Construction
Local community members and property owners should be informed of the presence of the outside workforce, the construction schedule and movement of workers.	Project proponent	Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce	Project proponent and Contractor	Pre-Construction and Construction
Property owners, their workers, as well as local communities should be motivated to be involved in crime prevention and by reporting crimes.	Project proponent Local communities	All phases of project
The construction site should be fenced and access to the area controlled.	Project proponent and Contractor	All phases of project
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	Project proponent and Contractor	Construction
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners and ULM.	Project proponent ULM Local communities	Pre-Construction and when required

Performance Indicator	» No criminal activities and theft of livestock are reported. » No fires occur. » No on-site accidents occur » No long term increase in the prevalence of STD's
Monitoring	» Project proponent, and appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise the potential impact on the daily living and movement patterns and farming activities

The farms under investigation are currently used for farming (mainly sheep) and other smaller compatible production activities. During the construction phase some negative impacts on the resource use on the farms are anticipated due to the extent of the construction activities. Alternative grazing areas would have to be found for the sheep currently grazing on the areas to be used for the wind turbines and solar panels. Farming activities could furthermore be negatively impacted on by general intrusions and noise associated with the construction activities such as the increase in vehicular movement and possible blasting noise.

Some intrusion impacts due to the construction activities and vehicular movements (noise and dust) on the surrounding property owners could be experienced, but it is not anticipated that their farming activities would be negatively affected during the construction phase, except if construction workers and/or jobseekers would enter these properties and in the event that stock thefts occur.

Project component/s	Construction activities could impact on the farming activities undertaken on the farms under investigation, as well as impact on the activities and daily living and movement patterns of the surrounding farms
Potential Impact	Loss of resource use Dust and noise pollution General intrusion
Activities/risk sources	Possible loss of income should sheep farming not continue Increased risk of accidents due to increase in vehicle movement Possible degradation of local roads Dust and noise pollution negatively affecting farming activities
Mitigation: Target/Objective	Limit any negative impacts on the farming activities and on the surrounding property owners' daily living and movement patterns

Mitigation: Action/control	Responsibility	Timeframe
Additional access roads at the construction sites should be kept to a minimum. Access roads and entrances to the site should be carefully planned to limit any intrusion on the neighbouring property owners and road users	Contractor	Construction
Noise and dust pollution should be limited. Gravel roads could be sprayed with water to limit dust creation if economically feasible and reasonable from an environmental perspective (water scarce area)	Contractor	Construction
Surrounding property owners should be notified if and when blasting would occur	Project proponent and Contractor	Construction
Construction vehicles should adhere to the speed limits and should be inspected to	Project proponent and Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
ensure that these are in good working order and not overloaded		
The movement of abnormal loads should be communicated to the property owners in the study area and the necessary permits and authorisations should be obtained from the relevant government departments	Project proponent Local communities	Construction
Source general construction material and goods locally where available to limit transportation of these over long distances	Project proponent and Contractor	Construction
The property owners affected should put pro-active measures in place to find alternative grazing areas for the sheep currently grazing on the affected areas	Project proponent	Construction
Local labourers should be used during the construction phase to limit the inflow of outsiders to the area	Project proponent ULM	Construction

Performance Indicator	» No loss of resource use and no loss of income » No noise and dust pollution » Limited intrusions on surrounding property owners » Limited or no reports from property owners regarding problems with construction activities and workforce » No degradation of local roads
Monitoring	» Project proponent, and appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Noise control

Projected noise levels during construction of the Wind Energy Facility were modelled using the methods as proposed by SANS 10357:2004. The resulting future noise projections indicated that the construction activities, as modelled for the worst case scenario, would not comply with the Noise Control Regulations (GN R154), but would comply with the acceptable day rating levels as per the SANS 10103:2008 guidelines.

Various construction activities would be taking place during the development of the facility, but due to the relative proximity to the closest potentially sensitive receptors (such as PSR06 and PSR07), it could pose a noise risk to them. The significance of this noise impact was defined to be of a low to medium significance. However, mitigation measures were still proposed that could reduce the potential noise impacts, risks and the probability of any complaints being registered.

Project component/s	Construction of infrastructure, including but not limited to: turbine system (foundation, tower, PV panels, nacelle, and rotor), substation(s), access roads and electrical power cabling.
Potential Impact	» Increased noise levels at potentially sensitive receptors » Potentially changing the acceptable land use capability
Activity/risk source	» Any construction activities taking place within 500 m from potentially sensitive receptors
Mitigation: Target/Objective	» Ensure equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Ensure that maximum noise levels at potentially sensitive receptors be less than 65 dBA. » Prevent the generation of disturbing or nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with the Noise Control Regulations

Mitigation: Action/control	Responsibility	Timeframe
Establish a line of communication and notify all stakeholders and potentially sensitive receptors of the means of registering any issues, complaints or comments.	ECO	All phases of project
Notify potentially sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 m) of the potentially sensitive receptors is to start. Following information to be presented in writing: » Description of activity to take place » Estimated duration of activity » Working hours » Contact details of responsible party	Contractor, ECO	At least 2 days, but not more than 5 days before activity is to commence
Ensure that all equipment is maintained and fitted with the required noise abatement equipment.	ECO	Weekly inspection
Measure the peak noise levels of equipment used when operational and keep database of noise levels	Acoustical Consultant / Approved Noise Inspection Authority	Start of project Quarterly during construction phase
When any noise complaints are received, noise monitoring should be conducted at the complainant, followed by feedback regarding noise levels measured	Acoustical Consultant / Approved Noise Inspection Authority	Within 7 days after complaint was registered
The construction crew must abide by the local by-laws regarding noise.	Contractor, ECO	Duration of construction phase
Where possible construction work should be	Contractor	As required

Mitigation: Action/control	Responsibility	Timeframe
undertaken during normal working hours (06H00 – 18H00), from Monday to Saturday; If agreements can be reached (in writing) with the all the surrounding (within a 1000 m distance) potentially sensitive receptors, these working hours can be extended.		

Performance Indicator	» Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors (8 hours). » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA. » No noise complaints are registered
Monitoring	» Quarterly noise monitoring by an Acoustic Consultant or Approved Noise Inspection Authority. » Noise monitoring to be conducted downwind from all noisy activities or at potentially sensitive receptors when work is taking place within 1 000 meters from a potentially sensitive receptor. » Monitoring to take place every time that a noise complaint is registered.

OBJECTIVE: Management of dust and emissions to air

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the main and internal access roads.

Project component/s	Construction and establishment activities associated with the Renewable Energy Facility and associated infrastructure.
Potential Impact	» Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment.
Activities/risk sources	» Clearing of vegetation and topsoil » Excavation, grading, scraping » Transport of materials, equipment and components on internal access roads » Re-entrainment of deposited dust by vehicle movements » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces

	» Fuel burning vehicle engines
Mitigation: Target/Objective	» To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase

Mitigation: Action/control	**Responsibility**	**Timeframe**
Roads must be maintained to a manner that will ensure that dust from road or vehicle sources is not visibly excessive. Ensure that damage to roads is repaired on completion of construction phase.	Contractor	Site establishment; duration of construction
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins.	Contractor	Duration of contract
Speed of construction vehicles must be restricted, as defined by the ECO.	Contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable once construction is completed in an area.	Contractor	At completion of construction phase
Construction vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem must be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor	Duration of contract

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures on roads implemented for all heavy vehicles that require such measures during the construction phase commences. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	» Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods: * Visual daily inspections of dust generation by construction activities throughout the construction phase. * Immediate reporting by personnel of any potential or actual

	issues with nuisance dust or emissions to the Project Manager. * A complaints register must be maintained, in which any complaints from residents/the community will be logged. Complaints will be investigated and, where appropriate, acted upon. * An incident reporting system must be used to record non-conformances to the EMP.

OBJECTIVE: Management of impacts of the proposed Karoo Renewable Energy Facility development on the archaeological and fossil material.

The main cause of impacts to archaeological and fossil material during construction activities is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large-scale excavations for foundations will damage archaeological sites, as will road construction activities. Archaeological mitigation must take place prior to the start of construction.

If at any stage during the construction phase any semblance of a fossil is observed, it would be vital to stop the work immediately and report this occurrence to SAHRA and / or a professional palaeontologist as soon as possible so that appropriate mitigation measures can be implemented. Generally fossils can be removed quickly and would therefore not delay or hinder construction operations.

In the unlikely event that any concentrations of archaeological/fossil material or human remains are uncovered during further development of the site, all work must immediately cease and be should reported to the Albany Museum, Mr. Lloyd Rossouw and/or the South African Heritage Resources Agency so that systematic and professional investigation/excavations can be undertaken. Sufficient time should be allowed to remove/collect such material.

Construction managers/foremen should be informed before the start of construction on the possible types of heritage sites and cultural material they may encounter and the correct procedures to follow when they encounter sites. It is suggested that one person be trained to be on site and report to the site manager when possible sites are encountered.

Project	» Wind turbines

component/s	» PV panels » Access roads » Associated infrastructure
Potential Impact	» Irreplaceable loss of the archaeological heritage and fossil material
Activity/risk source	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » Power line construction activities
Mitigation: Target/Objective	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
Report exposed human remains to SAHRA to guide on removal process	SAHRA, heritage consultant authority/archaeologists/ ECO	Pre-construction
If at any stage during the construction phase any semblance of a fossil were to be observed, it would be vital to recover the fossil and report the occurrence to Mr Lloyd Rossouw.	SARGE/ Contractor/ Appointed professional archaeologist/s in consultation with palaeontology Specialist/ ECO	Construction
If a heritage object is found, work in that area must be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	SARGE/ Contractor/ appointed professional archaeologist/ ECO	Construction
No construction activities may take place within 100m of stone wall structures, rock shelters containing paintings, and rocky outcrops with boulders containing rock engravings.	SARGE /Contractor/appointed professional archaeologist/ ECO	Construction
The ridges and rocky outcrops surrounding the locations proposed for the construction of the PV solar panels and wind turbines should be investigated to establish whether further rock shelters with rock paintings and rocky outcrops with boulders containing rock engravings may be impacted.	SARGE /Contractor/ appointed professional archaeologist/ ECO	Pre-construction
Rock shelters containing rock paintings and rocky outcrops with boulders containing rock engravings, and stone wall structures within 100m of the construction and development activities to be fenced off to protect the sensitive area from any negative impact.	SARGE/Contractor/ appointed relevant heritage authority or professional archaeologist/ ECO	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
Monitoring vegetation clearing and construction activities	SARGE/Contractor/ appointed relevant professional archaeologist/ ECO	Construction
A pre-excavation survey and possibly 2nd phase assessments as required for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act 25 of 1999.	SARGE, Appointed Palaeontologist	Pre-construction

Performance Indicator	» Zero disturbance outside of designated work areas » All heritage/fossil material located are dealt with as per the legislative guidelines » A record is kept of all instances of accidental disturbance of heritage/fossil material, as well as post construction review of impacts on landscape context. » Compliance with the recommendations in the heritage report and South African Heritage Resources Agency's (SAHRA's) Record of Decision (RoD), Letter of Appointment (LoA) of a professional archaeologist/s » Site visit, assessment report and recommendations to SAHRA in terms of Palaeontology
Monitoring	» Supervision of all clearing and earthworks by ECO throughout construction phase

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Karoo Renewable Energy Facility.

The duration of the construction phase of the facility is dependent on the number of turbines being constructed as well as the scale and extent of the proposed PV plant. During the construction period, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

In this environment, dust from construction work is also likely to represent a significant visual impact.

Project component/s	» Wind Turbines » PV plant and » Ancillary infrastructure (i.e. substations, power lines and access roads)

Potential Impact	» Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing.
Activity/risk source	» The viewing of the above mentioned by observers on or near the site.
Mitigation: Target/Objective	» Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.

Mitigation: Action/control	Responsibility	Timeframe
Reduce the construction period through careful planning and productive implementation of resources.	SARGE , Contractor	Construction
Plan the placement of lay-down areas and temporary construction camps in order to minimise vegetation clearing	SARGE , Contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	SARGE , Contractor	Construction
Ensure that rubble, litter and disused construction materials are managed and removed regularly.	SARGE , Contractor	Construction
Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way	SARGE , Contractor	Construction
Reduce and control construction dust through the use of approved dust suppression techniques.	SARGE , Contractor	Construction
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	SARGE , Contractor	Construction
Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.	SARGE , Contractor	Construction

Performance Indicator	» Vegetation cover on and in the vicinity of the site is intact with no evidence of degradation or erosion.
Monitoring	» Monitoring of vegetation clearing during construction. » Monitoring of rehabilitated areas post construction.

OBJECTIVE: Traffic management and transportation of equipment and materials to site

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment (including turbine and PV components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and

access relate to works within the site boundary (i.e. the Renewable Energy Facility and ancillary infrastructure) and external works outside the site boundary.

Project component/s	» Wind turbines » PV array » Substations » Power lines
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted » Risk of accidents » Deterioration of road pavement conditions (i.e. both surfaced and gravel road) due to abnormal loads
Activity/risk source	» Transportation of project components to site
Mitigation: Target/Objective	» To minimise impact of traffic associated with the construction of the facility on local traffic » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction

Mitigation: Action/control	Responsibility	Timeframe
All relevant permits for abnormal loads must be applied for from the relevant authority.	Contractor, Transportation contractor)	Duration of contract
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor, Transportation contractor)	Duration of contract
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards).	Contractor	Duration of contract
Appropriate maintenance of all vehicles must be ensured.	Contractor	Duration of contract
All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract

Performance Indicator	» No traffic incidents involving SARGE personnel or appointed contractors » Appropriate signage in place

	» No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the Renewable Energy Facility
Monitoring	» Visual monitoring of dust produced by traffic movement » Visual monitoring of traffic control measures to ensure they are effective » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances and waste

The construction phase of the Renewable Energy Facility will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility will include general solid waste, hazardous waste and liquid waste. A guideline for integrated management of construction waste is included as Appendix B of this EMP.

Project component/s	» Storage and handling of chemicals, hazardous substances and waste
Potential Impact	» Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Pollution of the surrounding environment through inappropriate waste management practices » Litter or contamination of the site or water through poor waste management practices » Pollution of water and soil resources
Activity/risk source	» Wind turbine construction activities » Solar array construction activities » Power line construction activities » Substation construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons » To ensure that the storage and maintenance of machinery on-site

	does not cause pollution of the environment or harm to persons » To comply with waste management guidelines developed by contractor » To minimise production of waste » To ensure appropriate waste handling, storage and disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Soil contaminated/ polluted because of a major spill must be removed from the site and disposed of at a licensed hazardous waste disposal facility. Soils contaminated/ polluted through minor spills can be treated on site provided they are contained and have not penetrated the soil surface.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site outside of designated areas (except for emergencies or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
All stored fuels to be maintained within a bunded area and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor ECO	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
appropriately bunded, and stored in compliance with MSDS files.		
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Pre-construction
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract
Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
No waste may be buried or burnt on site	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Dispose of all solid waste collected at an appropriately registered waste disposal site. The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may waste be burnt on site.	Contractor	Duration of contract
Where a registered waste site is not available close to the construction site, provide a method statement with	Contractor	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
regard to waste management.		
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction

Performance Indicator	» No chemical spills outside of designated storage areas » No water or soil contamination by spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase » A complaints register must be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » Observation and supervision of waste management practices throughout construction phase » Waste collection to be monitored on a regular basis » Waste documentation completed » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

OBJECTIVE: Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report, and this EMP, as well as the requirements of all relevant environmental legislation.

Project component/s	» Wind turbines » PV array/s » Access roads » Substations » Power lines
Potential Impact	» Pollution/contamination of the environment

	» Disturbance to the environment
Activity/risk source	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
Mitigation: Target/Objective	» To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment

Mitigation: Action/control	**Responsibility**	**Timeframe**
The terms of this EMP and the Environmental Authorisation (once issued) will be included in all tender documentation and Contractors contracts.	SARGE	Tender process
An ECO must be permanently on site throughout the road construction, cable laying, and turbine foundation excavation periods, and at other times should visit the site at least once a week.	SARGE	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting will be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract
Cooking/meals must take place in a designated area; no firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the ECO or personnel authorised by the ECO must disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract
Contractors appointed by SARGE 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.	Contractor (and sub-contractor/s)	Construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne by the contractor	Contractor (and sub-contractor/s)	Construction

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMP » No complaints regarding contractor behaviour or habits » Code of Conduct drafted before commencement of construction phase.

	» Briefing session with construction workers held at outset of construction phase
Monitoring	» Observation and supervision of Contractor practices throughout construction phase. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

5.3. Institutional Arrangements: Roles and Responsibilities for the Construction Phase of the Renewable Energy Facility

As the Proponent, SARGE must ensure that the implementation of the Renewable Energy Facility complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation. SARGE will retain various key roles and responsibilities during the construction of the Renewable Energy Facility. These are outlined below.

OBJECTIVE: To establish clear reporting, communication and responsibilities in relation to environmental incident

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

» Ensure of all specifications and legal constraints specifically concerning the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that SARGE and its Contractor(s) are made aware of all stipulations within the EMP.
» Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully conversant with the Environmental Impact Assessment for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (SARGE's On-site Representative) will:

- Be fully knowledgeable with the contents of the Environmental Impact Assessment.
- Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
- Be fully knowledgeable with the contents of the Environmental Management Plan.
- Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
- Have overall responsibility of the EMP and its implementation.
- Conduct audits to ensure compliance to the EMP.
- Ensure there is communication with the Project Manager, the Environmental Control Officer, and relevant discipline Engineers on matters concerning the environment.
- Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
- Confine activities to the demarcated construction site.

The **Environmental Control Officer** (ECO) will be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specification. Accordingly, the ECO will:

- Be fully knowledgeable with the contents with the Environmental Impact Assessment.
- Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
- Be fully knowledgeable with the contents with the Environmental Management Plan.
- Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
- Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address this.
- Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- Ensure that activities on site comply with all relevant environmental legislation.
- Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMP.
- Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.

» Ensure that there is communication with the Site Manager regarding the monitoring of the site.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.

Contractors and Service Providers: All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

» Ensuring adherence to the environmental management specifications.
» Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMP.
» Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
» Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
» Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
» Ensuring that a register of all public complaints is maintained.
» Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

5.4. Detailing Method Statements

OBJECTIVE: To ensure all construction activities/practices/procedures are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMP

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager (and ECO).

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's

proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

» Construction procedures
» Materials and equipment to be used
» Getting the equipment to and from site
» How the equipment/material will be moved while on-site
» How and where material will be stored
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
» Timing and location of activities
» Compliance/non-compliance with the Specifications, and
» Any other information deemed necessary by the Site Manager.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

5.5. Awareness and Competence: Construction Phase of the Renewable Energy Facility

OBJECTIVE: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar

with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.

» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
» Awareness of any other environmental matters, which are deemed necessary by the ECO.
» Ensuring that appropriate communication tools are used to outline the environmental "do's" and "don'ts" (as per the environmental awareness training course) to employees.
» Records must be kept of those that have completed the relevant training.
» Refresher sessions must be held to ensure the contractor's staff are aware of their environmental obligations.

5.6. Monitoring Programme: Construction Phase of the Renewable Energy Facility

OBJECTIVE: To monitor the performance of the control strategies employed against environmental objectives and standards.

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, SARGE will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
» Ensure adequate and appropriate interventions to address non-compliance
» Ensure adequate and appropriate interventions to address environmental degradation
» Provide a mechanism for the lodging and resolution of public complaints

» Ensure appropriate and adequate record keeping related to environmental compliance
» Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site
» Aid communication and feedback to authorities and stakeholders.

The ECO will ensure compliance with the EMP, and to conduct monitoring activities. The ECO must have the appropriate experience and qualifications to undertake the necessary tasks. The ECO will report any non-compliance or where corrective action is necessary to the Site Manager and/or any other monitoring body stipulated by the regulating authorities.

MANAGEMENT PLAN FOR RENEWABLE ENERGY FACILITY: CHAPTER 6 REHABILITATION OF DISTURBED AREAS

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

Overall Goal for the Rehabilitation of Disturbed Areas: Undertake the rehabilitation measures in a way that:

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

6.2. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

OBJECTIVE: To ensure appropriate rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

The main areas requiring rehabilitation will be the laydown areas adjacent to the turbines, the crane tracks alongside the permanent access roads, any cable routings where these fall outside the above-mentioned areas, and disturbed areas around the substations and maintenance building, and disturbed areas associated with the power line tower foundations, substation sites and access roads.

Project component/s	» Renewable Energy Facility (including laydown areas) » Power line servitudes and associated service roads » Substation sites and associated access road » Access roads not required for operation and maintenance
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/risk	» Temporary laydown areas

source	» Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed

Mitigation: Action/control	**Responsibility**	**Timeframe**
All temporary facilities, equipment, and waste materials must be removed from site as soon as practically possible after construction is complete.	Contractor	Following execution of works
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Completion of construction activities in an area

Performance Indicator	» All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites » Completed site free of erosion and alien invasive plants
Monitoring	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented. » On-going alien plant monitoring and removal should be undertaken on an annual basis for the life of facility. » Botanist to monitor rehabilitation every two years after first sowing.

MANAGEMENT PLAN FOR RENEWABLE ENERGY FACILITY: CHAPTER 7 OPERATION

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the Renewable Energy Facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the Renewable Energy Facility in a way that:

» Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
» Enables the Renewable Energy Facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, farming practices, traffic and road use, and effects on local residents.
» Minimises impacts on birds and other fauna using the site.
» Monitors and evaluates the impacts of the Renewable Energy Facility on birds that frequent the area, in particular monitoring of bird strikes, bird nesting activities and water bird uses of the wetlands on the site.
» Monitors the actual noise impacts of the Renewable Energy Facility.
» Establishes an environmental baseline for Renewable Energy Facility sites in South Africa, particularly with regard to priority bird species using the site.

7.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Minimisation of visual impacts

The primary visual impact, namely that of the wind turbines is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts. However, the sympathetic placement of the turbines with respect to the topography may ameliorate the magnitude of the impact somewhat.

The functional design of the structures and the dimensions of the facility 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 potential for mitigation is therefore low or non-existent. Due to the nature of the area within which the facility is planned, there are only a few potentially sensitive receptors.

Other impacts include impacts associated with lighting of substations, and the aircraft warning lights mounted on top of the hub of the wind turbines. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to (Appendix D), as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

Project component/s	» Wind turbines » Substations » Power lines and service roads for power line servitudes
Potential Impact	» Visual impact of facility degradation and vegetation rehabilitation failure.
Activity/risk source	» The viewing of the above mentioned by observers on or near the site.
Mitigation: Target/Objective	» Well maintained and neat facility » To minimise potential for visual impact » To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft » Minimise contrast with surrounding environment and visibility of the turbines to humans » The containment of light emitted from the substations in order to eliminate the risk of additional night-time visual impacts.

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility in an aesthetically pleasing way.	SARGE	Operation, Maintenance
Monitor rehabilitated areas, and implement remedial action as and when required.	SARGE	Operation, Maintenance
Aviation warning lights must be mounted on turbine hub or such measures required by the Civil Aviation Authority. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous flashing lights on the turbines representing the outer perimeter of the facility.	SARGE	Erection, maintenance
The turbines will be painted a pale, matt, non-reflective colour (i.e. off white, as specified) and it will be ensured that the specified paint colour is complied with before	Contractor	Erection of turbines

Mitigation: Action/control	Responsibility	Timeframe
erection of the turbines.		
Ensure that proper planning is undertaken regarding the placement of lighting structures for the substations and that light fixtures only illuminate areas inside the substation site.	SARGE	Construction, operation, maintenance
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.	SARGE	Erection, maintenance
Maintain the general appearance of the facility in an aesthetically pleasing way.	SARGE	Operation, maintenance
Undertake regular maintenance of light fixtures.	SARGE	Operation, maintenance
Limit access to the Renewable Energy Facility site, power line and substation to along existing access roads.	SARGE	Operation, maintenance
Avoid the unnecessary removal of vegetation within the power line servitudes and limit access to the servitudes (during both construction and operational phases) along existing access roads.	SARGE	Operation, maintenance
Mitigation of lighting impacts includes the pro-active design, planning, and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. Additional measures include the following: » Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); » Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; » Making use of minimum lumen or wattage in fixtures; » Making use of down-lighters, or shielded fixtures; » Making use of Low Pressure Sodium lighting or other types of low impact lighting. » Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.	SARGE / lighting engineer	Operation, maintenance

Performance Indicator	» Well maintained and neat facility with intact vegetation on and in the vicinity of the facility. » Minimised visual intrusion on surrounding areas » Appropriate visibility of infrastructure to aircraft » The effective containment of the light to the substation site.
Monitoring	» Monitoring of rehabilitated areas.

	» Ensure that aviation warning lights or other measures are installed before construction is completed » Ensure that Aviation warning lights or other measures are functional at all times » The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE: Protection of avifauna

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most concerning issue. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of turbines in South Africa with which bird interactions have been monitored. Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Infrastructure associated with the facility often also impacts on birds. Overhead power lines also pose a collision and possibly an electrocution threat to certain bird species.

Project component/s	» Wind turbines » Photovoltaic solar panels » Access roads » Substation linking the facility to the electricity grid » Underground cabling » Power lines
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades and or PV array/s » Disturbance to or loss of birds as a result of collision with the overhead power line » Electrocution on power lines and substations
Activity/risk source	» Appointment of unqualified personnel to do the monitoring » Results of pre-construction monitoring not integrated into the final layout and/or the mitigation scheme » Lack of clear communication between the scientist analysing the monitoring data and the client » Misinterpretation of either the pre- or post-construction monitoring data
Mitigation: Target/Objective	» The delivery of an effective impact mitigation scheme for the facility, informed initially by influence of pre-construction monitoring on final construction plans, and refined by post-construction monitoring of actual impacts, and resulting adjustments in management practices and mitigation measures applied

Mitigation: Action/control	Responsibility	Timeframe
Ensuring that all new power lines are marked with bird flight diverters from origin to destination (with marker and fitting standards as per the industry standard)	SARGE Environmental Manager	Construction - operation
Review monitoring report on the full year of post-construction monitoring, and integrate findings into operational EMP and broader mitigation scheme	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	1 year post-construction
Review the need for further monitoring	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	1 year post-construction

Performance Indicator	» Quantifiable reductions in avian impacts once the facility is operational
Monitoring	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades or power line.

OBJECTIVE: Appropriate handling and management of hazardous substances and waste

The operation of the Renewable Energy Facility will involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and liquid waste.

Project component/s	» Wind turbines » Substations
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Generators and gearbox - turbines » Transformers and switchgear - substation » Fuel and oil storage » Maintenance building
Mitigation: Target/Objective	» To comply with waste management guidelines » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	SARGE	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	SARGE	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	SARGE	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it will be cleaned up according to specified standards regarding bioremediation.	SARGE	Operation, maintenance
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	SARGE /waste management contractor	Operation
Used oils and chemicals: » Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	SARGE	Operation
It must be ensured that volumes of any hazardous waste stored on site do not exceed $30m^3$. Should this volume be exceeded, a waste license will be required to be obtained.	SARGE	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	SARGE	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	SARGE	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	SARGE	Operation

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping » Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately

	» Provision of all appropriate waste manifests » No contamination of soil or water
Monitoring	» Waste collection must be monitored on a regular basis· » Waste documentation must be completed and available for inspection on request » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the SHE Representative. All appropriate waste disposal certificates accompany the monthly reports.

OBJECTIVE: Noise control

The resulting future noise projections indicated that the operation of the facility would comply with the Noise Control Regulations (GN R154) as well as the guidelines as proposed by SANS 10103:2008 during periods when the wind speeds are less than 6 m/s. Non-compliance at higher wind speeds however is due to the ambient sound levels associated with wind induced noises at these higher wind speeds. The significance of this noise impact was determined to be low. Mitigation measures, however, are proposed to ensure that the potential noise impacts and risks be optimally minimized.

The following measures are recommended to define the performance of the developer in mitigating the projected impacts and reducing the significance of the noise impact.

Project Component(s)	Operational Phase
Potential Impact	» Increased noise levels at potentially sensitive receptors » Changing ambient sound levels could change the acceptable land use capability » Disturbing character of sound
Activity/Risk source	» Simultaneous operation of a number of turbines
Mitigation Target/Objective	» Ensure that the change in ambient sound levels as experienced by potentially sensitive receptors is less than 5 dBA » Prevent the generation of nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors

Mitigation: Action/control	Responsibility	Timeframe
Defining the ambient sound levels in 10 minute bins over a period of 14 days before the operational phase	Acoustical Consultant / Approved Noise	Before operational

Mitigation: Action/control	Responsibility	Timeframe
starts inside and outside of the dwellings of at PSR06 and PSR07. 10 minute sampling bins should be co-ordinated with 10 m wind speed. Because PSR01 might be developed in the future, similar sampling is recommended for that site.	Inspection Authority	phase commence
Design and implement a noise monitoring programme	Acoustical Consultant / Approved Noise Inspection Authority	Before operational phase commence
Add additional noise monitoring points at any complainants that registered a noise complaint relating to the operation of the Renewable Energy Facility	Acoustical Consultant / Approved Noise Inspection Authority	With quarterly monitoring

Performance Indicator	» Ensure that the change in ambient sound levels as experienced by potentially sensitive receptors is less than 7 dBA
Monitoring	» Quarterly noise monitoring by an Acoustic Consultant or Approved Noise Inspection Authority for the first year of operation. Monitoring should take place over a 24 hour period in 10 minute bins, with the results co-ordinated with the 10 m wind speed. Noise monitoring programme to be developed and implemented at the start of operation.

OBJECTIVE: Maximise local employment and business opportunities associated with the operation phase

The proposed Karoo Renewable Energy Facility is not labour intensive and approximately twenty (20) permanent employment opportunities will manifest during the operational phase of the project. Security personnel would be on site on a permanent basis, although the other personnel would not necessarily be on site on a daily basis due to the remote operational system.

Therefore, long-term direct job opportunities for locals exist, although limited. However, in an area with such high unemployment figures, these limited opportunities should still be seen as a positive impact on the quality of life of those benefiting from the employment.

Some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. These opportunities for local service providers to render services to the Karoo Renewable Energy Facility could include maintenance of the guardhouse, gardening at the guardhouse, cleaning services, security services and maintenance or replacement of general equipment.

Project component/s	Operation and maintenance of the facility
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised
Activities/risk sources	Locals are not employed where the local skills exist Local procurement is not undertaken if possible Local businesses are not supported
Mitigation: Target/Objective	Maximise the appointment of local employees

Mitigation: Action/control	Responsibility	Timeframe
Contractors should capacitate locals where practical	Project proponent Contractor	Pre-operation and Operation
The project proponent should consider training and capacity building programmes to lessen the skills disparity	Project proponent	Operation
The skill requirements should be communicated to the local community leaders and community based organisations	Project proponent	Operation
Make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers	Project proponent	Operation
An equitable process whereby minorities and previously disadvantaged individuals (women) are taken into account should be implemented.	Project proponent	Operation
Local sourcing of materials and general services to assist in providing more economic and employment opportunities for the local people	Project proponent	Operation

Performance Indicator	» An employee list should be drawn up indicating the percentage of locals employed. » A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower skilled working levels to higher skilled and possibly management levels. » Local procurement is undertaken
Monitoring	» Project proponent should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Assist with social development and enhance capacity building and skills development within the local communities

An important positive role that the project proponent could fulfil as part of their social responsibility towards the local communities is to assist in addressing community development needs.

The project applicant is therefore accountable to optimise the productive potential of those employed at the proposed facility's operation through capacity building and skills training, whether these individuals are temporary or permanent employees.

One of the aims of the project could be to revitalise the area in terms of job creation and infrastructure development, in other words it would focus on broad based empowerment.

Project component/s	Capacity building and skills training undertaken during the operational phase.
Potential Impact	Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills Contribution towards local development initiatives
Activity/risk source	No social responsibility from project proponent No contribution towards local development initiatives Inefficient training or lack of capacity building and skills training
Mitigation: Target/Objective	Capacity building and skills training should be continuously undertaken during the operational phase of the project Positive social responsibility initiatives

Mitigation: Action/control	Responsibility	Timeframe
Involvement in upliftment programmes could be done according to the needs identified as part of the IDP of the Ubuntu Local Municipality	Project proponent and ULM	Operation
Capacity building and skills training should form part of the social development support provided to local communities	Project proponent and ULM	Operation
Individual tailor made training programmes for full time employees should be embarked upon in association with accredited training facilities to ensure long term benefits to those involved	Project proponent	Operation
In cases for the middle to lower skilled jobs, where the relevant skills do not exist, training should be provided to willing local community	Project proponent ULM	Operation

Mitigation: Action/control	Responsibility	Timeframe
members to enable them to fill the positions		
The Skills Development Levy should be established once the project is commissioned to ensure that the benefits of the implementation thereof reach the local communities from the start of the project	Project proponent ULM	Operation
Bursary candidates should be identified and selected based on a stringent screening process	Project proponent	Operation
The project applicant should create conditions that are conducive for the involvement of entrepreneurs, small businesses and SMME's during the operational phase for rendering ancillary services to the proposed facility	Project proponent	Operation

Performance Indicator	» A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower skilled working levels to higher skilled and possibly management levels. » Local development initiatives should be supported
Monitoring	» Project proponent should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Minimise the potential impact on farming activities and on the surrounding landowners

Once operational, the impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (e.g. the increase in traffic to and from site, possible dust creation of vehicle movement on gravel roads on site and possible increase in criminal activities). Limited number of workers would be on site on a daily basis with subsequent minimal social impacts in this regard.

The only land that would be sterilised would be the areas actually used for the turbine structures, the footprint of the solar mounts, access roads, fire breaks and associated buildings and sub-station buildings. Grazing of sheep could thus continue on the sections of land between the turbines and panels.

It is not anticipated that any activities undertaken as part of the operation and maintenance of the Karoo Renewable Energy facility would negatively impact on the surrounding property owners' daily living patterns. They would thus be able to continue

their farming practices without interference from the wind energy and solar energy facilities. An increase in noise is however seen as a concern.

Project component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners » Impact on farming activities on site
Potential Impact	» Possible limited intrusion impact on surrounding land owners » Possible phasing out of sheep farming
Activity/risk source	» Increase in traffic to and from site could impact on daily living and movement patterns of surrounding residents.
Mitigation: Target/Objective	» Effective management of the facility » Mitigation of intrusion impacts on property owners » Mitigation of impact on farming activities » Limit noise impacts

Mitigation: Action/control	Responsibility	Timeframe
Effective management of the facility to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services, and limiting any increase in noise levels	Project proponent	Operation
Vehicle movement to and from the site should be minimised	Project proponent Employees	Operation
Local roads should be maintained to keep the road surface up to standard	Project proponent	Operation
Reduce any negative impacts on farming activities by keeping fencing within the site to a minimum and designing fencing to maximise efficiency of stock movements	Project proponent	Operation
Limit the development on new access roads on site as far as possible	Project proponent and Contractors	Operation
The engineering design of the turbines should thus ensure the least noise as possible	Project proponent and Contractors	Operation

Performance Indicator	» No environmental pollution occur (waste, water and sanitation related) » Limited noise pollution » No intrusion on private properties and on the activities undertaken on the surrounding properties » Continuation of farming activities » No noise increase
Monitoring	» Project proponent should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met

OBJECTIVE: Minimise the potential visual impact and subsequent impact on the sense of place and land value

The social impact associated with the impact on the sense of place relates to the change in the landscape character and visual impact of the proposed wind energy facility and PV plant. Even though the area is rural in character, there is some limited existing disturbance by infrastructure such as roads, transmission lines, telephone poles, the railway line, the existing substation, scattered homesteads and so forth. The proposed facility is thus expected to add to the existing negative visual impact of these types of infrastructure on the open relatively undisturbed rural landscape and therefore on the sense of place. The permanent visual impact would thus be limited to a small minority of residents and road users, but due to the scarcely populated area it would have a more marked effect on these residents' quiet, undisturbed rural lifestyle, their quality of life and their sense of place.

In this regard it should also be noted that the impact of the turbines, substations and PV panels on the visual environment would differ based on the receptors' perception of such facilities. Some people could view the turbines and panels as having a significant negative impact on the beauty of the landscape, while others could view them in a positive light and even use the presence of the facility as part of the area's marketing efforts.

Another impact is a source of concern is referred to as "shadow flicker" which could impact on nearby residents or motorists making use of local roads. The above mentioned visual impact and the viewers and/or landowners' perception of the facility could result in devaluation of the land in the short term. Once operational it is however expected that the value of the land would return to normal should the facility be properly managed with no negative impacts on the surrounding landowners' activities.

Project component/s	» Visual impact due to turbines and PV panels and subsequent impact on sense of place » Possible negative impact on land value
Potential Impact	» Visual impact and subsequent impact on sense of place » Possible negative impact on land value
Activity/risk source	» Devaluation of land value » Change of landscape character
Mitigation: Target/Objective	» Limit the negative visual impact and thereby limiting the negative impact on the sense of place

Mitigation: Action/control	Responsibility	Timeframe
The design and specific positioning of the panels and turbines should aim to minimise	Project proponent	Pre-operation Operation

Mitigation: Action/control	Responsibility	Timeframe
the possible negative visual impact of the facility on the surrounding property owners		
The Visual, Noise and Heritage Impact Assessment recommendations should be implemented to limit any potential negative impacts on the sense of place	Project proponent	Pre-operation Operation
The panel mounts should have the lowest height practically possible	Project proponent	Pre-operation Operation
The natural landscape could possibly be used to conceal some of the panels and turbines	Project proponent	Pre-operation Operation
It should be ensured that there is no reflection from the panels	Project proponent and Contractor / Engineer	Pre-operation Operation
The design of the blades should limit any possible "shadow flicker"	Project proponent and Contractor / Engineer	Pre-operation Operation

Performance Indicator	» The visual impact is limited as far as possible » The change in the landscape character is contained as far as possible » The facility is managed according to international best practice to avoid any negative impacts on the land value
Monitoring	» Project proponent and surrounding property owners must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

MANAGEMENT PLAN FOR RENEWABLE ENERGY FACILITY: CHAPTER 8 DECOMMISSIONING

The turbine and PV array infrastructure which will be utilised for the proposed Renewable Energy Facility is expected to have a lifespan of 25 to 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines and PV panels with more appropriate technology/infrastructure available at that time.

8.1. Site Preparation

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

8.2 Disassemble and Replace Existing Components

Both the wind (turbine and tower sections) and solar components (PV panels and support structures) of the proposed facility will be disassembled once it reaches the end of its economic lifespan. A large crane would be required for disassembling the turbine and tower sections. Once disassembled, the components will be reused, recycled, or disposed of in accordance with regulatory requirements. If deemed necessary, the disassembled components would be replaced with more appropriate technology/infrastructure available at that time.

OBJECTIVE: To avoid and or minimise the potential impacts associated with the decommissioning phase.

Project component/s	» Decommissioning phase of the Renewable Energy Facility.
Potential Impact	» Decommissioning will result in job losses, which in turn can result in a number of social impacts, such as reduced quality of life, stress, depression etc. However, the number of people affected (~20) is relatively small. Decommissioning is also similar to the construction phase in that it will also create temporary employment opportunities.

Activity/risk source	» Decommissioning of the Renewable Energy Facility.
Mitigation: Target/Objective	» To avoid and or minimise the potential social impacts associated with decommissioning phase of the Renewable Energy Facility.

Mitigation: Action/control	Responsibility	Timeframe
SARGE should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the facility is decommissioned Retrenchments should comply with South African Labour legislation of the day.	SARGE	Decommissioning
SARGE should investigate the option of relocating employees to other renewable energy facilities when the Karoo Renewable Energy Facility is decommissioned (if feasible).	SARGE	Decommissioning
SARGE should establish an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 25 - 30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.	SARGE	Decommissioning

Performance Indicator	South African Labour legislation at the relevant time
Monitoring	Retrenchments should comply with South African Labour legislation of the day