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# WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE, WESTERN CAPE PROVINCE

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## PRINCIPLES OF ENVIRONMENTAL MANAGEMENT FOR THE WIND ENERGY FACILITY PROJECT:

### DRAFT CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Submitted in draft form as part of the Draft EIA Report

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## PROJECT DETAILS

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- DEAT Reference No.** : 12/12/20/913
- Title** : Environmental Impact Assessment Process  
Draft Environmental Management Plan: Proposed  
Wind Energy Facility and Associated Infrastructure,  
Western Cape Province
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- Client** : Eskom Holdings Limited (Eskom Generation Division)
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## PURPOSE & 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”<sup>1</sup>. The objective of this Environmental Management Plan 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 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 purpose of the 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 has been developed as a set of environmental specifications (i.e. principles of environmental management for the wind energy facility project), which will be appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation will be provided through the inclusion of various monitoring and implementation tools and interactive GIS-interface for assisted use of the EMP).

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 Wind Energy Facility.
- » 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.

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<sup>1</sup> Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

- » To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- » To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- » To facilitate appropriate and proactive response to unforeseen events or changes in project implementation that were not considered in the EIA process.

The mitigation issues identified within the Environmental Impact Assessment process are systematically addressed in the EMP, ensuring a high level of environmental performance while minimising adverse impacts.

It should be noted that since this EMP is part of the EIA process undertaken for the Wind Energy Facility project, it is important that this guideline document be read in conjunction with the Scoping Report and EIA Report. This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental process. This draft EMP for construction and operation activities has been compiled in accordance with Section 34 of the EIA Regulations and will be further developed in line with comments received, and in terms of specific requirements list in any authorisations issued for the proposed project.

## PROJECT DETAILS

## CHAPTER 2

Eskom Holdings Limited is proposing to establish a commercial wind energy facility on a site on the West Coast (north of the Olifants River) in the Western Cape Province. This development is proposed to comprise a cluster of up to 100 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed over an area of less than 20 km<sup>2</sup> in extent.

The construction and commissioning of the facility is proposed to be implemented in two phases, with the first commissioned phase of the project planned to generate in the order of 100 MW (that is, approximately fifty 2 MW to 2,5 MW industry standard turbines). The second phase would comprise the remaining fifty turbines (the total facility not exceeding 100 turbines). The generating capacity of the facility will be dictated by the choice of turbine (a current industry standard of 2 MW turbines has been assumed at this time). The infrastructure associated with the total wind energy facility would, therefore, include:

- » Up to 100 **wind turbine units** (approximately 80 m high steel tower and nacelle, with a hub height of 80 m; 90m diameter rotor (consisting of 3x45 m blades)).
- » A concrete **foundation** (of 15 m x 15 m) to support each turbine tower.
- » Underground electrical cabling between turbines and the substation.
- » A **substation** (with a footprint of 80 m X 80 m) in an appropriate position to receive generated power via underground distribution cabling from each wind turbine.
- » Overhead **power line** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
- » An access/**haul road** to the site from the main R363 road at Koekenaap
- » Internal **access roads** providing access to each wind turbine site (with a permanent travel surface of approximately 6 m in width)
- » A **visitors centre** at the facility entrance (with a footprint of ~400 m<sup>2</sup> under roof).

The Wind Energy Facility will operate as a peaking power generation station (with a nominal generating capacity in the order 200 MW utilising current best available technologies). The facility will be fuelled by wind. No other fuels will be used as a generating fuel during the operation phase.

The design and integration of the system components will be conducive to a safe working system, under all climatic, operating and fault conditions. The following design conditions are relevant to the wind energy generating turbines proposed for the facility:

- » A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation.

- » The turbines can start generating at wind speeds of approximately 10 km/hr (~3 m/s).
- » Nominal wind speeds required for full power operation vary between ~45 km/hr and 60 km/hr (12.5 m/s and 17 m/s).
- » At very high wind speeds (typically over 90 km/hr (25 m/s)) the wind turbine will cease power generation and shut down. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.
- » Once operating, the facility can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The wind energy facility will connect to the National electricity grid via a 132 kV power line from the facility to Juno Substation, situated outside Vredendal.

The main activities associated with the wind energy facility project are detailed in Table 1 and comprise the following:

**Table 1:** Summary of activities that form part of the proposed wind energy facility development

Main Activity/Project Component	Components of Activity	Details
<b><i>Construction of Wind Energy Facility</i></b>		
Conduct surveys	<ul style="list-style-type: none"> <li>» Geotechnical survey by geotechnical engineer:                             <ul style="list-style-type: none"> <li>* Non-intrusive ground testing. Drilling rig 4m high</li> <li>* Drilling 30m to extract samples</li> <li>* Test pits</li> </ul> </li> <li>» Site survey and confirmation of the turbine micro-siting footprint (this micro-siting exercise will be required to be undertaken in conjunction with qualified heritage and vegetation specialists)</li> <li>» Survey of substation site (to be undertaken in conjunction with qualified heritage and vegetation specialists)</li> <li>» Survey of power line servitude to determine tower locations (to be undertaken in conjunction with qualified heritage, vegetation and avifauna specialists)</li> </ul>	<ul style="list-style-type: none"> <li>» All surveys to be undertaken prior to initiating construction</li> </ul>
Establishment of access roads to the site	<ul style="list-style-type: none"> <li>» Upgrade access/haul road to the site (Skaapvlei road DR2225)</li> <li>» Establish internal access roads:                             <ul style="list-style-type: none"> <li>* 6m wide permanent roadway within the site between the turbines for use during construction and operation phase</li> <li>* Temporary track (adjacent to and utilising part of the permanent road) of</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>» Access roads will be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary.</li> <li>» Existing access roads to the site (including the road to Skaapvlei) will be utilised, and upgraded where required.</li> <li>» Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and</li> </ul>

Main Activity/Project Component	Components of Activity	Details
	<p>between 12m and 14m in width for use by the crawler crane during construction phase only.</p>	<p>circulation.</p> <ul style="list-style-type: none"> <li>» The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as heritage and vegetation specialists surveys).</li> <li>» To accommodate the large crawler crane required for turbine assembly, a track of 12m to 14m in width is required to be established on the site to accommodate the passage of the fully rigged crawler crane.</li> </ul>
Undertake site preparation	<ul style="list-style-type: none"> <li>» Site establishment of offices with ablutions and stores, contractors yards:                             <ul style="list-style-type: none"> <li>* IT receiver and repeater</li> <li>* Laydown areas for steel reinforcement cages</li> <li>* Laydown areas for formwork</li> </ul> </li> <li>» Establishment of internal access roads (permanent and temporary roads)</li> <li>» Clearance of vegetation at the footprint of each turbine (permanent)</li> <li>» Excavations for foundations</li> </ul>	<ul style="list-style-type: none"> <li>» These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.</li> <li>» Some of the activities associated with offices will be placed on a portion of the 40x40 laydown area. This area can be rehabilitated after construction.</li> </ul>
Establishment of lay down areas on site	<ul style="list-style-type: none"> <li>» Lay down areas (temporary footprint 40m x 40m) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment.</li> <li>» Temporary lay down area for crane assembly (max 20m x 150m wide).</li> </ul>	<ul style="list-style-type: none"> <li>» 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.</li> <li>» A large lay down area (approximately 20 m wide x 150 m long) 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</li> </ul>

Main Activity/Project Component	Components of Activity	Details
Construct wind turbine foundations	<ul style="list-style-type: none"> <li>» Concrete foundations of approximately 15 m x 15 m x 2 m depth at each turbine location</li> </ul>	<p>crawler crane from all sides.</p> <ul style="list-style-type: none"> <li>» Foundation holes will be mechanically excavated to a depth of approximately 2 m. Shoring and safety barriers will be erected.</li> <li>» Earthmatts and cable sleeves will be installed</li> <li>» Reinforced steel cages will be erected.</li> <li>» Formwork erected and then dismantled after concrete pour.</li> <li>» Concrete will possibly be batched at an appropriate location off-site and brought to site when required via ready-mix cement trucks (approximately 20 trucks per foundation).</li> <li>» The reinforced concrete foundation will be poured and support a mounting ring.</li> <li>» The foundation will then be left up to cure before the turbine erection. Formwork will be removed and the foundation will be backfilled and compacted.</li> <li>» If the geological conditions dictate, the use of alternative foundations will be considered (e.g. reinforced piles).</li> </ul>
Transport of components and equipment to site	<ul style="list-style-type: none"> <li>» Flatbed trucks will be used to transport all components to site:                             <ul style="list-style-type: none"> <li>* Turbine units consist of a tower comprised of 4 segments of approximately 20 m in length, a nacelle weighing approximately 83 tons, and three rotor blades (each of approximately 45 m in length).</li> <li>* Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>» The wind turbine, including tower, will be brought to site by the supplier in sections.</li> <li>» 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 45 m blades) and load limitations (i.e. the nacelle).</li> <li>» 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)</li> </ul>

Main Activity/Project Component	Components of Activity	Details
	<p>a 750 ton main lift crawler crane) to erect the wind turbines.</p> <ul style="list-style-type: none"> <li>* The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.).</li> <li>* The components required for the establishment of the substation (including transformers)</li> <li>* Components required for the establishment of the power line (including towers and cabling)</li> <li>* Ready-mix cement trucks for turbine, substation and visitor's centre foundations</li> </ul>	<p>as a result of abnormal loading.</p> <ul style="list-style-type: none"> <li>» The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.</li> </ul>
Erect turbines	<ul style="list-style-type: none"> <li>» Large lifting crane for lifting of large, heavy components</li> <li>» A small crane for the assembly of the rotor</li> <li>» Wind turbine components:                             <ul style="list-style-type: none"> <li>* tower of approximately 78m in height</li> <li>* nacelle with hub height at ~ 80m</li> <li>* rotor approximately 90m in diameter</li> <li>* temporary diesel generators and compressors for construction and commissioning purposes</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>» The large lifting crane will lift the tower sections into place.</li> <li>» The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower.</li> <li>» 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.</li> <li>» It will take approximately 2 days to erect the turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.</li> <li>» Turbines will be sited up to 300m apart from each other, with rows being 650m apart. This is to minimise wake effects and wind turbulence.</li> </ul>

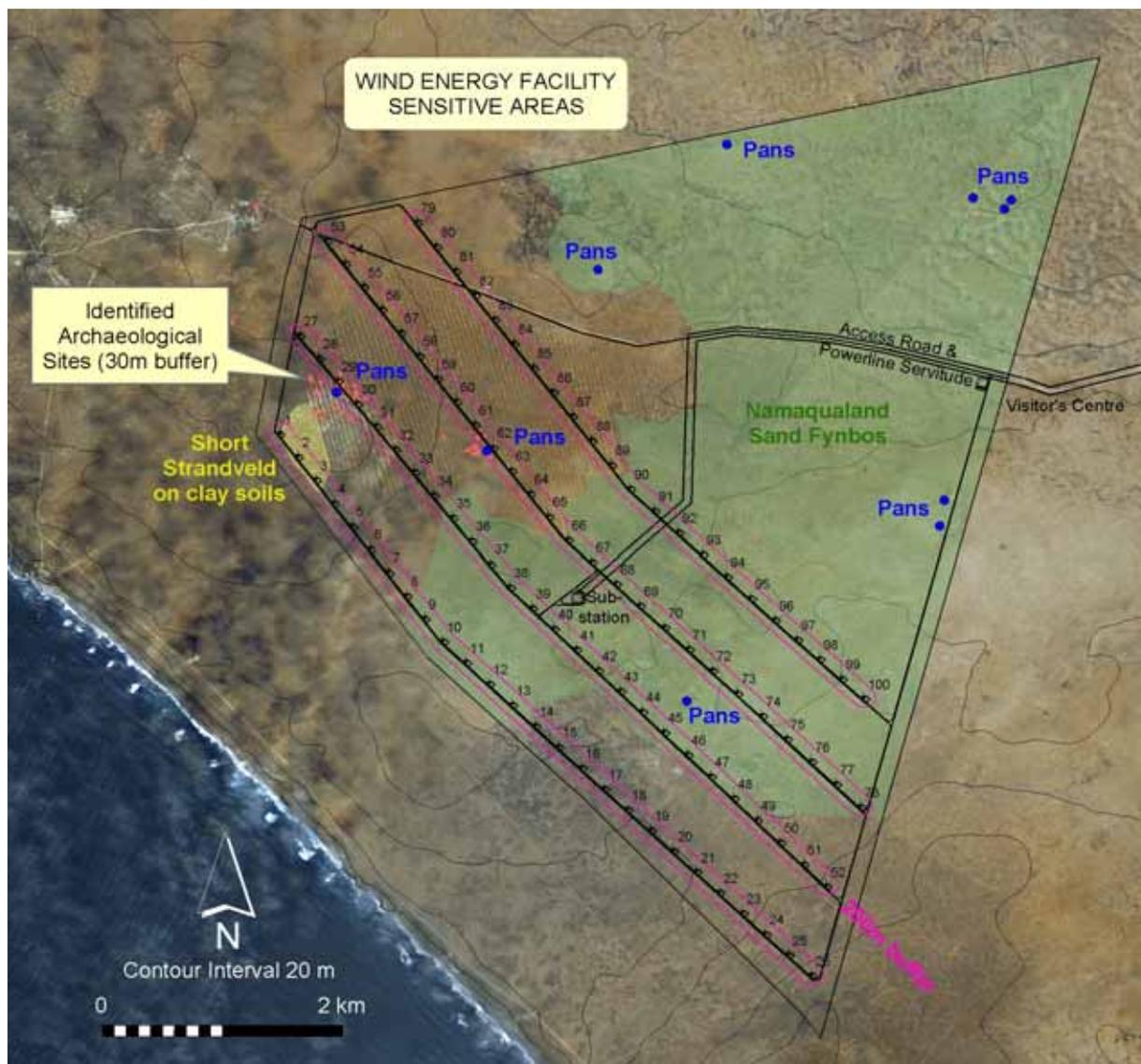
Main Activity/Project Component	Components of Activity	Details
		<ul style="list-style-type: none"> <li>» The lifting cranes will be required to move between the turbine sites. The crawler crane is self-powered and can “crawl” between locations should the ground conditions allow. When assembled, the crawler crane has a track width of approximately 11m.</li> </ul>
Construct substation	<ul style="list-style-type: none"> <li>» Gas Insulated Substation</li> <li>» Other substation components</li> <li>» Security fencing around high-voltage (HV) Yard</li> </ul>	<ul style="list-style-type: none"> <li>» The substation will be constructed with a high-voltage (HV) yard footprint of up to 80m x 80m.</li> <li>» The substation would be constructed in the following simplified sequence:                             <ul style="list-style-type: none"> <li>* Step 1: Survey of the site</li> <li>* Step 2: Site clearing and levelling and construction of access road to substation site</li> <li>* Step 3: Construction of terrace and foundations</li> <li>* Step 4: Assembly, erection and installation of equipment (including transformers)</li> <li>* Step 5: Connection of conductors to equipment</li> <li>* Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.</li> </ul> </li> <li>» The positioning of the substation has been informed by the micro-siting of the turbines</li> </ul>
Establishment of ancillary infrastructure	<ul style="list-style-type: none"> <li>» A small office structure and visitors centre</li> </ul>	<ul style="list-style-type: none"> <li>» These structures would occupy a footprint of about 400 m<sup>2</sup> under roof.</li> <li>» Will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction.</li> <li>» A lay down area for building materials and equipment associated with these buildings will also be required.</li> <li>» Permanent areas such as parking areas will also be associated with the visitor’s centre.</li> </ul>

Main Activity/Project Component	Components of Activity	Details
Connection of wind turbines to the on-site substation	<ul style="list-style-type: none"> <li>» 33 kV underground electrical cabling connecting each turbine to the substation</li> </ul>	<ul style="list-style-type: none"> <li>» The installation of these cables will require the excavation of trenches, approximately 1m in depth within which these cables can then be laid.</li> <li>» The underground cables would follow the internal access roads.</li> </ul>
Connect substation to power grid	<ul style="list-style-type: none"> <li>» Double-circuit 132 kV power line connecting the substation to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal).</li> </ul>	<ul style="list-style-type: none"> <li>» A route for the power line will be assessed, surveyed and pegged prior to construction.</li> <li>» The power line servitude will follow other existing linear infrastructure (including roads and or other power lines) as closely as possible to consolidate linear infrastructure in the area, and to minimise the need for additional points of access.</li> <li>» The power line will be constructed utilising a monopole steel pole structure with stand-off insulators and will be approximately 24 m in height.</li> <li>» A servitude of approximately 32 m will be required for this power line.</li> </ul>
Commissioning of the facility	<ul style="list-style-type: none"> <li>» Commissioning of Phase 1</li> <li>» Commissioning of Phase 2</li> </ul>	<ul style="list-style-type: none"> <li>» 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.</li> <li>» Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance.</li> <li>» Physical adjustments may be needed such as changing the pitch of the blades.</li> <li>» The schedule for this activity will be subject to site and weather conditions.</li> </ul>
Undertake site remediation	<ul style="list-style-type: none"> <li>» Remove all construction equipment from the site</li> <li>» Rehabilitation of temporarily disturbed areas where practical and reasonable</li> </ul>	<ul style="list-style-type: none"> <li>» 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.</li> <li>» Due to the mobility of the sandy soils, and as rehabilitation and</li> </ul>

Main Activity/Project Component	Components of Activity	Details
		recovery of vegetation on the site will be slow, rehabilitation activities will (as far as possible) be carried out at each turbine location once construction of that particular turbine is completed.
<b><i>Operation of the Wind Energy Facility</i></b>		
Operation	» Operation of turbines within the wind energy facility	<ul style="list-style-type: none"> <li>» Once operational, the wind energy facility will be monitored remotely.</li> <li>» It is estimated that the operational phase of the project will provide employment for approximately 6 skilled staff members (based off site), who will be responsible for monitoring and maintenance when required.</li> <li>» No permanent staff will be required on site for any extended period of time.</li> <li>» Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities.</li> </ul>
Maintenance	<ul style="list-style-type: none"> <li>» Oil and grease - turbines</li> <li>» Transformer oil - substation</li> <li>» Waste products</li> </ul>	<ul style="list-style-type: none"> <li>» The wind turbine will be subject to periodic maintenance and inspection.</li> <li>» Periodic oil changes will be required.</li> <li>» Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.</li> <li>» The turbine infrastructure which will be utilised for the proposed wind energy facility on the West Coast is expected to have a lifespan of approximately 20 - 30 years (with maintenance).</li> </ul>
<b><i>Decommissioning</i></b>		
Site preparation	<ul style="list-style-type: none"> <li>» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes</li> <li>» Preparation of the site (e.g. lay down areas,</li> </ul>	<ul style="list-style-type: none"> <li>» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise</li> </ul>

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





**Figure 2:** Detail of the expected site layout and extent in relation to identified areas of some environmental sensitivity

The proposed construction activities include:

- Site Preparation and Earthworks on site (including access roads)
- Access road upgrade
- Foundations – undertaken consecutively
- Turbine components begin arrival in South Africa and transport to site
- Arrival of cranes on site and crane assembly
- Turbine erection and Generator installation
- Commissioning of each turbine
- Substation Construction
- Power line construction
- Visitor's centre construction

The hours of operation for construction activities are guided by the Environment Conservation Act. If the project requires construction work outside of the designated hours, regulatory authorities and affected stakeholders will be consulted and subsequent negotiations will be made to ensure the suitability of the revised activities.

In terms of the findings of the EIA Report, various planning, construction and operation-related environmental impacts were identified, including:

- » Disturbance of flora and fauna
- » Impacts on water resources (sedimentation and water quality)
- » Increase in traffic volumes in the vicinity of the construction site and impact on existing road infrastructure
- » Noise pollution
- » Socio-economic impacts
- » Windblown dust
- » Storage and utilisation of hazardous substances on site
- » Disturbance to sense of place, visual aesthetics
- » Security risks
- » Light pollution

None of the construction phase impacts were deemed to have a highly significant impact on the environment, given their relatively short duration and localised extent. Many of the construction phase impacts were, however, assessed as being of medium significance and requiring specific mitigation interventions in order to avoid and minimise impacts on the biophysical and especially the human environment.

The EMP has been developed 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 avoiding or minimising potential impacts.

**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 Eskom to achieve environmental compliance. For each of the phases for the Wind Energy Facility project, an overarching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management plan 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 plan 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

<b>Project component/s</b>	List of project components affecting the objective, i.e.: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	Brief description of potential environmental impact if objective is not met
<b>Activity/risk source</b>	Description of activities which could impact on achieving objective
<b>Mitigation: Target/Objective</b>	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 facility, equipment)
- » 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, achieved, etc.

### 3.1. Project Team

This draft EMP was compiled by:

<b>EMP Compilers:</b>	Karen Jodas	Savannah Environmental
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	Prof Mouton – fauna	Department of Botany & Zoology, Stellenbosch University
	Andrew Jenkins - ornithologist	Endangered Wildlife Trust (EWT)
	Garry Paterson – agricultural potential	Agricultural Research Council (ARC): Institute for Soil, Climate & Water
	Mark Rynhoud - Soils and erosion potential	Geological and Environmental Services (GES)
	Pete Illgner – geomorphology and wetlands	
	Lourens du Plessis - visual	MetroGIS
	Mark Pinder – traffic and transportation	Arup SA (Pty) Ltd
	Tony Barbour & Schalk van der Merwve - Social	
	Adrian Jongens - Acoustics consultant	Jongens Keet & Associates (JKA)

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	Ian Smit	Eskom Corporate Division: EIRD – Chief Engineer
	Isaac Blou	Eskom Enterprises Division: Engineering Department – Engineer
	Dan Dukhan	Eskom Enterprises Division: Engineering Department – Civil Engineer
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## MANAGEMENT PLAN FOR WIND ENERGY FACILITY: PLANNING & DESIGN

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## CHAPTER 4

### 4.1. Goal for Planning and Design

**Overall Goal for Planning and Design:** Undertake the planning and design phase of the wind 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 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, including the power line alignment
- » Enables the wind 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.

**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 wind energy facility development site, no absolute 'no go' areas were identified. Nor were areas of regionally high or very high sensitivity identified.

However, potentially sensitive areas, including the Short Strandveld and Namaqualand Sand Fynbos vegetation types, archaeological sites (with an approximate 30 m buffer for each site) as well as possible pans (with an approximate 50 m buffer) have been highlighted as being potentially affected by the facility. These areas are illustrated in Figure 2.

The areas illustrated on Figure 1 above should be avoided through sensitive design of the facility (where possible) or alternatively subject to intensive ground-truthing prior to construction works beginning are clustered to the western corner of the site. These areas include:

1. The high local sensitivity area (clay hill) in terms of vegetation at the western corner of the site. This area supports an unusual mix of species on heavier clay soils, including at least one Red Data Book listed species (*Leucoptera nodosa*).
2. Two small wetlands which may be located within 50 m of a turbine and/or internal access road.
3. A concentration of small shell middens recorded at each of two dried springs that were once waterholes with potable water. The value of the waterhole-related sites is that they represent two complete systems of occupation which are of scientific value in terms of their potential to provide information about the cultural affinities of the people who lived there, and the time depth of their occupancy of the area.

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

1. The extent of the high local sensitivity area (clay hill) at the western corner of the site should be accurately defined through further field survey/ground-truthing. This will determine a) if the area can be effectively avoided at the design stage through micro-siting relocation of the first three turbine positions (turbine numbers 1-3) and associated infrastructure within the impact corridor; b) the need for a suitably qualified botanist to point out the sensitive areas and recommend the mitigation measures to allow the positioning of infrastructure in this area with the least impact possible, and to plan a Search and Rescue program for any plants of concern that can be translocated; or c) if the turbine positions require total re-positioning within the turbine field/site to avoid the area completely (best practice requires avoidance of impacts). Although the placement of turbines and infrastructure in this area cannot be viewed as a fatal flaw, it is supported (from a botanical perspective) that the impact be avoided or minimised to an acceptable level.
2. In order to ensure adequate buffer areas around the wetlands on the site, turbine number 62 and associated access road (Row C) and the access road within Row B of turbines should be shifted at least 20 m and 10 m respectively within the impact corridor.
3. In order to minimise impacts on historical and archaeological heritage, a) a program of archaeological sampling of Late Stone Age archaeological sites of the two clusters of sites, and b) where technically possible, micro adjustment of turbine and road positions (turbine numbers 29 and 30 in Row B; and turbine numbers 61 and 62 in Row C) should be implemented. All sampling should be undertaken ahead of construction work at the affected sites. Eskom will need to apply for sampling permits from Heritage Western Cape<sup>2</sup>. The permit application will need to be accompanied by detailed specifications of which sites are to be

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<sup>2</sup> The turn around period for the issuing of heritage permits by Heritage Western Cape is generally about 5 weeks. Permits are usually valid for a period of a year but can be extended for a further 2 years if required.

sampled, how large the samples will be, and how and where the sampled material will be stored (the NHRA requires indefinite institutional storage of all archaeological remains). This information should be informed by the design of the facility. Once the archaeological sampling is completed, a permit for destruction of any remaining archaeological material on any of the development sites must be obtained from Heritage Western Cape.

Ideally, unvegetated and poorly vegetated aeolian dunes and sediments, which represent a high erosion risk, should be avoided for the siting of infrastructure. However, as most of the area selected for the siting of the turbines and within the power line corridors is associated with such areas, the crests of dunes, which represent the most sensitive component of the landscape, should be avoided wherever possible.

<b>Project component/s</b>	Project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	» Design fails to respond optimally to the environmental consideration
<b>Activities/risk sources</b>	<ul style="list-style-type: none"> <li>» Positioning of turbines and access roads within 200 m corridor</li> <li>» Positioning of substation</li> <li>» Alignment of power line within 200 m corridor</li> <li>» Upgrading of Skaapvlei Road (DR2225)</li> </ul>
<b>Mitigation: Target/Objective</b>	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, aquatic ecology (i.e. wetlands and pans), avifauna, and heritage	Engineering Design Consultant/successful turbine supplier Eskom	Tender Design & Design Review Stage
Consider shifting of turbine numbers 1-3, and 62, as well as the access roads associated with turbine number 62 and Row B.	Engineering Design Consultant/successful turbine supplier Eskom	Tender Design & Design Review Stage
Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements	Eskom	Tender Design & Design Review Stage

Performance Indicator	<ul style="list-style-type: none"> <li>» Design meets objectives and does not degrade the environment</li> <li>» Design and layouts etc respond to the mitigation measures and recommendations in the EIA report</li> </ul>
Monitoring	<ul style="list-style-type: none"> <li>» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the ECO prior to the commencement of construction</li> </ul>

**OBJECTIVE:** To ensure adequate regard has been taken of landowner concerns and that these are appropriately addressed

Impacts on current and future agricultural activities were identified through the EIA process to be of potential concern. It is Eskom's intention to purchase the three properties which comprise the 37 km<sup>2</sup> area. The end use of the property will be primarily for electricity generation (the property would be re-zoned to industrial in order to accommodate the facility). The option of granting grazing rights to the affected farmers would be required to be considered by Eskom. However, given the long regeneration periods for disturbances to the natural vegetation it will take time for the areas disturbed by the construction activities to recover. This, combined with the low stock carrying capacity in the area (approximately 1 SSU/10 ha), will impact on the economic viability of the affected farms. It is recommended that an opinion from an agricultural-economist specialist be sought once the final footprint for the proposed wind energy facility is available in order to understand the impact on each of the affected farm owners, and to inform the negotiation process undertaken by Eskom with the affected landowners.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
Potential Impact	<ul style="list-style-type: none"> <li>» Landowners impacted by proposed siting of facility, access road or power lines</li> <li>» Impacts on current and future agricultural activities</li> </ul>
Activities/risk sources	<ul style="list-style-type: none"> <li>» Positioning of turbines, access roads and substation</li> <li>» Alignment of power line within 200 m corridor</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To ensure adequate regard has been taken of concerns of affected and surrounding landowners and that these are appropriately addressed</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Initiate negotiations with landowners timeously	Eskom Lands and Rights	Ideally initiated together with submission of final EIA (which indicates preferred site layout and power line route). Finalised prior to site establishment commencement
Address reasonable expectations/ requests where possible		
In event of impasse follow legal expropriation route, but ensure that extent of expropriation is minimised, restrictions on land use are minimised and reasonable costs are paid		

Performance Indicator	<ul style="list-style-type: none"> <li>» Location and layout responds to issues recorded in the Issues Trail</li> <li>» Ideally, landowners should be satisfied with the outcome of the negotiations process. In the event of impasse requiring expropriation, landowners should be afforded reasonable and appropriate rights/ access</li> </ul>
Monitoring	» Not applicable

**OBJECTIVE:** To ensure selection of best environmental option for alignment of the power line

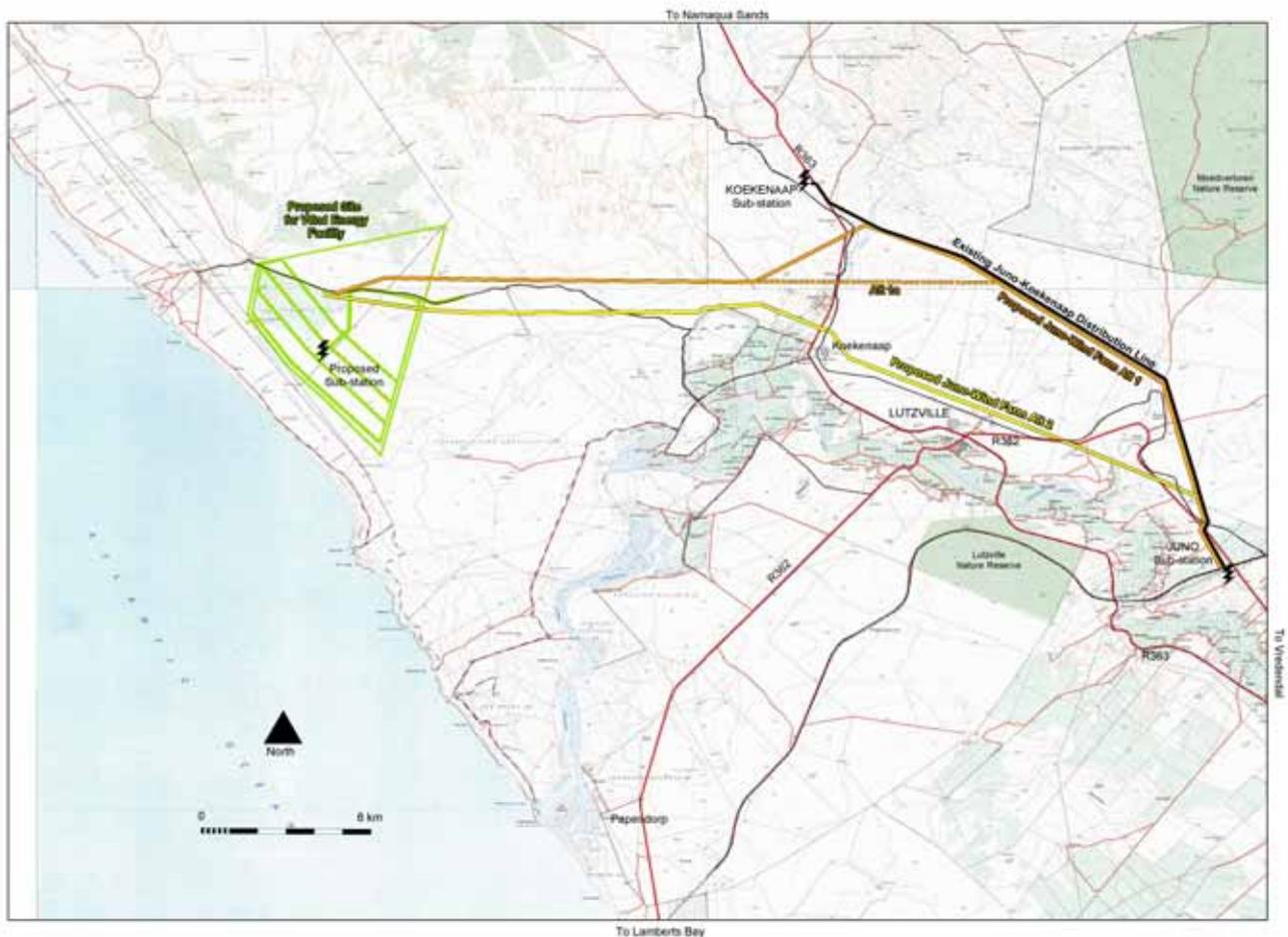
A double circuit 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal), a distance of approximately 40 km. Alternative routes/corridors for the 132 kV power line were identified and assessed in the EIA phase (refer to Figure 3).

From the results of the specialist investigations, Alternative 1 is nominated as the preferred power line alternative by the majority of specialist findings. Alternative 1a is also considered to be acceptable, with Alternative 2 being the least preferred.

One area of botanical sensitivity north of Koekenaap has been identified to be traversed by Alternative 1. This area comprises significant patches of Very High sensitivity vegetation, mostly in the form of Knersvlakte Quartz Vygieveld. With the implementation of Alternative 1, an impact of very high significance on vegetation is anticipated in this area due to long-term to permanent loss of vegetation and habitat in quartz patches in this area. A power line through these highly sensitive quartz patches would cause significant and permanent damage in the form of plant loss due to

crushing, and permanent habitat alteration. The fine covering of quartz pebbles is key to the habitat, and any heavy machinery severely disturbs this layer, effectively rendering the habitats unsuitable for these specialised plants for many decades after disturbance. Given that the quartz patches are fairly small and localised on a landscape scale, it is not considered acceptable to have infrastructure routed through them when they are relatively easy to avoid. The significance of this impact is not off-set by the fact that an existing disturbance occurs in the form of the existing power line. New impacts would develop with the introduction of new power line infrastructure.

Therefore, in order to avoid the only Very High impact associated with the construction of the Juno-Wind Farm power line, it is proposed that **Alternative 1 with sub-alternative 1a** is nominated as the preferred alternative. This alternative still meets the acceptance level for all identified environmental impacts, and will ensure that impacts are minimised to an acceptable level.



**Figure 3:** Alternative power line corridors as considered in the EIA

<b>Project component/s</b>	Project components affecting the objective: » power line
<b>Potential Impact</b>	» Route that degrades environment unnecessarily, particularly with respect to visual aesthetics, loss of indigenous flora and impacts on local communities/residents
<b>Activities/risk sources</b>	» Alignment of power line within 200 m corridor
<b>Mitigation: Target/Objective</b>	» To ensure selection of best environmental option for alignment for the power line

Mitigation: Action/control	Responsibility	Timeframe
Select alignment that curtails environmental impacts and enhances environmental benefits (Alternative 1 with sub-Alternative 1a), while being technically feasible and affordable	Eskom Distribution	Prior to submission of Final EIA
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, aquatic ecology (i.e. wetlands and pans), avifauna, and heritage	Eskom Distribution	Design phase

<b>Performance Indicator</b>	» Alignment meets objectives. » Selected alignment minimises any negative environmental impacts and maximises any benefits.
<b>Monitoring</b>	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the ECO prior to the commencement of construction

**OBJECTIVE:** To ensure the selection of the most appropriate road upgrade option for Skaapvlei road (DR2225)

The additional construction traffic to the site has the potential to lead to premature failure of access roads, both surfaced and gravel, between the source and the site. The gravel roads may need regular grading to smooth out the surface, but may need to be re-gravelled after completion of the project to restore it to its former condition. The formalisation of the main local access to an asphalt surface could be considered, provided the existing pavement structure is adequate.

In addition, in order to mitigate the impact of turning construction traffic and other vehicles using the R363, it is recommended that the intersection (and possibly the first 800 m portion of the Skaapvlei road (DR2225)) be reconstructed to a bituminous

surfaced road. This would also assist in minimising the noise impact on the residents of the agricultural smallholdings adjacent to the section of Skaapvlei road.

<b>Project component/s</b>	Project components affecting the objective: » Access road
<b>Potential Impact</b>	» Road surface deteriorates and is not safe for use » Deterioration of road results in unnecessary erosion and environmental degradation
<b>Activities/risk sources</b>	» Upgrading and maintenance of Skaapvlei road
<b>Mitigation: Target/Objective</b>	» To ensure the selection of the most appropriate road upgrade option for Skaapvlei road

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Select upgrade option that curtails environmental impacts and enhances benefits to other users of the Skaapvlei road, while being technically feasible and affordable and ensuring all properties along the Skaapvlei road has access to their properties	Eskom and Western Cape provincial administration	Design phase
Undertake detailed pavement design, as required	Engineering Design Consultant/Eskom	Detailed design phase

<b>Performance Indicator</b>	» Upgrade option meets objective. Selected option minimises any negative environmental impacts and maximises any benefits.
<b>Monitoring</b>	» Not applicable

## MANAGEMENT PLAN FOR WIND ENERGY FACILITY: CONSTRUCTION

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## CHAPTER 5

### 5.1. Overall Goal for Construction

**Overall Goal for Construction:** Undertake the construction phase of the wind energy facility in a way that:

- » Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- » Enables the wind energy facility construction 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 the impact on the vegetation and habitats 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, where possible, during construction, particularly with regard to priority bird species using the site.

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

#### OBJECTIVE: Securing the site and site establishment

The Contractor shall recognise that the site is situated relatively close to inhabited areas (albeit rural) and shall therefore take all reasonable measures to ensure the safety of people in the surrounding area. Where the public could be exposed to danger by any of the Works or site activities, the Contractor shall, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans, Xhosa and any other relevant indigenous languages, all to the approval of the Site Engineer.

All unattended open excavations shall be adequately demarcated (fencing shall consist of a minimum of three strands of wire wrapped with danger tape). Adequate protective measures must be implemented to prevent unauthorised access to the working area and internal access/haul routes.

<b>Project component/s</b>	Project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Hazards to landowners and public</li> <li>» Security of materials</li> </ul>
<b>Activities/risk sources</b>	<ul style="list-style-type: none"> <li>» Open excavations (foundations and cable trenches)</li> <li>» Movement of construction vehicles in the area and on site</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To secure the site against unauthorised entry</li> <li>» To protect members of the public/landowners</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Secure site in an appropriate manner. Where necessary to control access, fence and secure area. Contractor's equipment camp	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp	Contractor	Erection: during site establishment Maintenance: for duration of Contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Site is secure and there is no unauthorised entry</li> <li>» No members of the public/ landowners injured</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Regular visual inspection of fence for signs of deterioration/forced access</li> </ul>

**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 Skaapvlei road. The expected

vehicle movements per day for the transportation of the wind turbine components to the site will be approximately 1 vehicle per day over a 1-year period. It is estimated that 2 570 ready-mix cement truck loads will be required to be transported to the site over a 2 year period for construction of the total facility (including the wind turbine foundations, substation and visitor's centre).

The main access route to the site (i.e. Skaapvlei road (DR2225)) and the internal access roads will be gravel roads. Due to the arid nature of the area (i.e. low rainfall) and the windy conditions in the vicinity of the site, dust from gravel roads, dust generated from construction activities on site as well as vehicle entrained dust have been identified as potential issues of concern which require management.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
Potential Impact	<ul style="list-style-type: none"> <li>» 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.</li> <li>» Release of minor amounts of air pollutants (for example NO<sub>2</sub>, CO, PM10 and SO<sub>2</sub>) from vehicles and equipment.</li> </ul>
Activities/risk sources	<ul style="list-style-type: none"> <li>» Clearing of vegetation and topsoil</li> <li>» Excavation, grading, scraping</li> <li>» Transport of materials, equipment and components on Skaapvlei road and internal access roads</li> <li>» Re-entrainment of deposited dust by vehicle movements</li> <li>» Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces</li> <li>» Fuel burning vehicle engines</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To ensure emissions from all vehicles are minimised where possible for the duration of the construction phase</li> <li>» 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</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Roads will be maintained to a manner that will ensure that dust from road or vehicle sources will not exceed prescribed levels as soon as possible.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Appropriate dust suppressant will be applied on all exposed areas and stockpiles as required to minimise	Contractor	Duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
dust emissions		
Haul vehicles moving outside the construction site carrying material that can be wind-blown will be covered	Contractor	Duration of Contract
Speed of construction vehicles will be restricted	Contractor	Duration of Contract
Burning or incineration of any materials on site will be prohibited	Contractor	Duration of Contract
Specific fire safety precautions will be implemented during welding activities associated with the substation and power line construction (if appropriate)	Contractor	Duration of Contract
Dust-generating activities or earthworks, may need to be rescheduled or the frequency of dust control spraying will be increased during periods of high winds if visible dust is blowing toward nearby residences	Contractor	Duration of Contract
As far as possible and where practicable, roads will be routed away from sensitive areas	Contractor	Duration of Contract
Disturbed areas will be re-vegetated as soon as practicable	Contractor	At completion of the construction phase
Vehicles and equipment will be maintained in a road-worthy condition	Contractor	Duration of Contract
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem will be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor	Duration of Contract

<b>Performance Indicator</b>	» No complaints from affected residents or community regarding dust or vehicle emissions
<b>Monitoring</b>	<p>Monitoring will be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods:</p> <ul style="list-style-type: none"> <li>» Visual daily inspections of dust generation by construction activities throughout the construction phase. If considered necessary, dust gauges will be installed at nearby residences.</li> <li>» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Engineer.</li> <li>» A complaints register will be maintained, in which any complaints from residents/the community will be logged. Complaints will be investigated and, where appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>

**OBJECTIVE: Sediment control and water quality management**

Potential constraints with reference to the prevailing engineering geological and erosion risks that could occur in the study area, which were outlined during the Scoping Phase of the investigation include the following:

- » Unconsolidated sands with risk of erosion by both wind and water
- » Clayey material may be dispersive with associated erosion risk when exposed to the atmosphere
- » Karstic weathering conditions cannot be ignored in calcareous settings although this risk is considered extremely low in light of the prevailing arid climatic conditions
- » Compressible soils and poor surface drainage where clayey soil conditions and flat grades prevail
- » Ponding surface water and shallow perched water tables after wet periods would be encouraged. Adequate stormwater drainage would be essential in such areas.
- » Excavation sidewall stability and slope stability may be problematic where saturated sub-soils and steep cuttings are exposed.

Soil loss will be greater during wet periods than dry months. Intense rainfall periods out of the wet season can also cause significant soil loss, however. The provision of erosion control measures for developments where construction occurs through the drier months of the year is equally important as those planned for developments during winter months.

During the construction phase, limited activities would have the potential for contaminated water to enter the groundwater system. The vulnerability of the groundwater resource in the vicinity of the development site to the proposed land use activity is mitigated by factors such as the substantial depth to groundwater level, the intergranular and fractured type of aquifer that underlies most of the site, and the poor yield of boreholes in the area.

As this is particularly relevant to stormwater runoff, water quality impacts will be managed as part of the stormwater management system.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
Potential Impact	» Contaminated water entering surrounding system

Activities/risk sources	<ul style="list-style-type: none"> <li>» Stormwater run-off from sealed surfaces</li> <li>» Water and wind erosion of cleared and excavated areas</li> <li>» Accidental spills of petrochemical products (e.g. transformer oils associated with the operation of the substation and wind turbines) or cement on site or during transport of these products to the site</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To minimise erosion of sediment on site and along gravel access roads during construction</li> <li>» To provide permanent erosion and sediment control measures where required</li> <li>» To minimise the risk of contamination of surface water, groundwater and stormwater through leaks or spills of chemicals/polluting substances during the construction phase</li> <li>» To control disposal of potentially contaminated site water associated with the substation</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
A Stormwater Management Plan, detailing location and design of stormwater and sediment control devices will be prepared prior to the commencement of construction activities.	Contractor	Pre-construction
All possible stormwater and sediment control devices to will be constructed to the satisfaction of the administering authority. This will be completed and effective prior to the stripping of the topsoil, bulk earthworks to the site, service installation and road pavement construction	Contractor	Erection: during site establishment Maintenance: for duration of Contract
All stockpiles will be positioned away from drainage lines	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Sediment fencing will be erected downslope of all stockpiles to intercept any sediment and upslope runoff should be diverted away from stockpiles.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Soil loss from the site is related to the time that the soils are exposed, prior to rehabilitation / stabilisation. The time from commencement of construction to rehabilitation will be kept to a minimum to limit the period of surface exposure	Contractor	Duration of Contract
Overall planning and timing of any works will be carefully considered to ensure that they can be completed and vegetation successfully re-established	Contractor	Duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
before heavy winter rains.		
Disturbance of vegetation and topsoil will be kept to a practical minimum	Contractor	Duration of Contract
Retention of vegetation strips along the edge of roadways and watercourses for all components of the project is important to reduce the area of disturbance and minimise the potential for sediment entering drainage systems and water courses. These strips should be at least 10 m wide where possible.	Contractor	Duration of Contract
Where appropriate, exposed areas of sites will be protected by temporary banks and ditches upslope to contain and divert runoff	Contractor	Erection: during site establishment Maintenance: for duration of Contract
It may be necessary to use geotextiles to limit wind erosion in certain areas where wind erosion seems problematic. These will be spread out over the ground and staked down, as appropriate.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
The use of sites shadecloth fences (e.g. 1.2m high) may be necessary to limit wind erosion in areas excavated around tower foundations.	Contractor	Excavation of foundations & erection of wind turbines
A minimum time will be allowed to lapse between opening and closing of trenches for cabling, etc in order to protect against wind erosion.	Contractor	Duration of Contract
Any stockpiles will be protected against wind erosion (e.g. surrounded by shadecloth fences or damped down on a regular basis).	Contractor	Duration of Contract
Permanent drainage works will be provided as early as possible during construction	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Vehicular traffic will be controlled during construction, confining access, where possible, to proposed or existing road alignments.	Contractor	Duration of Contract
Culverts will be provided across drainage lines for any roads established within the power line servitude.	Contractor	Erection: during site establishment Maintenance: for duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
As far as possible, access to construction sites should be restricted to a single location.	Contractor	Duration of Contract
Temporary tracks used during construction will be graded to a crown and provided with effective surface drainage, to prevent runoff eroding adjacent land	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Movement of vehicles on site is to be along approved and formalised access roads only, which shall be adequately maintained throughout construction	Contractor	Duration of Contract
Materials on site which may contaminate surface or groundwater will be stored and handled in an appropriate manner	Contractor	Duration of Contract
Spill kits will be made available on site for the clean up of spills and leaks of contaminants	Contractor	Duration of Contract
Spill response procedures will include removal/disposal of potentially contaminated water	Contractor	Duration of Contract
Equipment will be refuelled within designated refuelling locations	Contractor	Duration of Contract
All stored fuels to be maintained within a bund.	Contractor	Duration of Contract
Spilled cement will be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site	Contractor	Duration of Contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor	Completion of construction
The sediment control and water quality structures used on site will be monitored and maintained in a fully operational state at all times.	Contractor	Duration of Contract
Fuel storage areas will be inspected regularly to ensure bund stability, integrity and function	Contractor	Duration of Contract
Construction machinery will be stored in an appropriately sealed and banded area.	Contractor	Duration of Contract
Oily water from bunds at the substation will be removed from site by licensed contractors.	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	Contractor	Duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
emergencies/incidents		
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of Contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Surface and ground water meet required water quality guideline levels</li> <li>» No evidence of water pollution or excessive sedimentation</li> <li>» No evidence of erosion is present in construction areas or along gravel access roads</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Weekly visual inspection of sediment and water quality control devices throughout construction phase and during or following major rain events.</li> <li>» Regular visual inspections of the construction areas and along gravel access roads</li> <li>» Immediate reporting by personnel of damaged or ineffective sediment control measures or potential water contamination to Site Engineer.</li> </ul>

**OBJECTIVE: Noise control**

Noise levels during construction of the proposed development have been modelled and show compliance with the Noise Control Regulations and SANS Guidelines for all residential locations including the closest locations at Skaapvlei.

However, results show that traffic flow, particularly of heavy-duty vehicles, during construction would probably result in a noise impact on the residents of the agricultural smallholdings adjacent to the Skaapvlei road who are situated close to the road. In order to minimise the noise during vehicular movement during the construction and operation of the facility it is recommended that the portion of the Skaapvlei road to the facility that passes through these smallholdings consist of a low-noise road surface. Transportation of heavy equipment, such as the turbine nacelles, by slow moving, ultra-heavy-duty vehicles will result in a noise impact on communities along the entire route taken by the vehicles.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	Nuisance noise from construction affecting the surrounding community

Activity/risk source	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Construction-related transport</li> <li>» Foundations or plant equipment installation</li> <li>» Building activities</li> <li>» Power line construction activities</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To minimise noise to any surrounding residences from the construction activities</li> <li>» To comply with Noise Control Regulations and SANS Guidelines.</li> <li>» To ensure noise levels are acceptable at smallholdings adjacent to Skaapvlei road.</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Construction hours will be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays) (in terms of the Environment Conservation Act). Should construction activities need to be undertaken outside of these times, the surrounding communities will be notified and appropriate approval will be obtained from DEA&DP.	Contractor	Duration of Contract
Construction noise will be managed according to the Noise Control Regulations and SANS 10103.	Contractor	Duration of Contract
All construction equipment, including vehicles, will be properly maintained in order to minimise noise generation.	Contractor	Duration of Contract

Performance Indicator	No complaints received concerning noise
Monitoring	<ul style="list-style-type: none"> <li>» 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.</li> </ul>

**OBJECTIVE: Minimisation of development footprint and disturbance to topsoil**

In order to minimise impacts on flora, fauna and ecological processes, the development footprint should be limited.

Project component/s	<p>List of project components affecting the objective:</p> <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
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<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impacts on natural vegetation</li> <li>» Impacts on soil</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Trenching activities for cable laying</li> <li>» Excavation for tower base foundations</li> <li>» Construction of site access road</li> <li>» Site preparation for lay-down area and site office/visitor's centre (e.g. compaction)</li> <li>» Borrow material source</li> <li>» Foundations or plant equipment installation</li> <li>» Track for crawler crane movement on-site</li> <li>» Power line construction activities</li> <li>» Stockpiling of topsoil, subsoil and spoil</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To retain natural vegetation in the western corner of the site, where possible.</li> <li>» To avoid the sensitive quartz patches located within the proposed power line corridor (Alternative 1) north of Koekenaap</li> <li>» To minimise footprints of disturbance of vegetation/habitats on-site</li> <li>» Remove and store all topsoil on areas that are to be excavated; and use this topsoil in later rehabilitation of disturbed areas</li> <li>» Fill material is to be sourced from tower base excavations</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared will be clearly marked in the field to avoid unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation will be kept to a minimum so that impact on flora and fauna is restricted	Contractor	Site establishment & duration of contract
Construction activities will be restricted to demarcated areas so that impact on flora and fauna is restricted	Contractor	Site establishment & duration of contract
All fill material will be sourced from a commercial off site suitable source, quarry or borrow pit. Where possible, material from tower base excavations will be used as fill on site.	Contractor	Duration of contract
Excavated topsoil (top 20 cm) will be stockpiled in laydown area separate from base material and covered until replaced during rehabilitation	Contractor	Site establishment & duration of contract
Topsoil will not be stripped or stockpiled when wet, as compaction will occur	Contractor	Site establishment Maintenance: for duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
The maximum topsoil height will not exceed 2 metres in order to preserve micro-organisms within the topsoil, which can be lost due to compaction and lack of oxygen	Contractor	Duration of Contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas</li> <li>» Minimise clearing of existing vegetation</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation clearing and soil management activities by ECO throughout construction phase.</li> <li>» Supervision of all clearing and earthworks.</li> </ul>

**OBJECTIVE: Protection of vegetation**

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. As there are no obvious concentrations of rare species or any especially threatened habitats or vegetation types on site there are no areas of regionally high or very high sensitivity. The development footprints will not impact on any botanical “no go” habitats or areas.

An area of high local sensitivity (clay hill) in terms of vegetation was recorded at the western corner of the site. This area supports an unusual mix of species on heavier clay soils, including at least one Red Data Book listed species (*Leucoptera nodosa*).

One area of botanical sensitivity north of Koekenaap has been identified to be traversed by power line Alternative 1. There are significant patches of Very High sensitivity vegetation in this area, mostly in the form of Knersvlakte Quartz Vygjeveld.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Clearing of construction footprints</li> <li>» Traffic to and from site</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Construction-related traffic</li> <li>» Foundations or plant equipment installation</li> <li>» Mobile construction equipment</li> <li>» Power line construction activities</li> <li>» Dumping or damage by construction equipment outside of demarcated construction areas.</li> </ul>

<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To retain natural vegetation in the western corner of the site, where possible.</li> <li>» To avoid the sensitive quartz patches located within the proposed power line corridor (Alternative 1) north of Koekenaap</li> <li>» To minimise footprints of disturbance of vegetation/habitats on-site</li> </ul>
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Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared will be clearly marked in the field to avoid unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
Undertake Search and Rescue (S&R) of certain translocatable, selected succulents, shrubs and bulbs occurring in development footprints.	Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation will be kept to a minimum so that the impact on flora and fauna is restricted	Contractor	Site establishment & duration of contract
All rescued species should be bagged (and cuttings taken where appropriate) and kept in an on-site nursery (if water can be provided; otherwise off site) and should be returned to site once all construction is completed and rehabilitation of disturbed areas is required.	Specialist/contractor or	Site establishment & duration of contract
A site rehabilitation programme should be implemented.	Contractor	Duration of contract
A weed eradication programme should be implemented, where necessary.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas</li> <li>» Minimise clearing of existing vegetation</li> <li>» Limited impacts on sensitive vegetation</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation clearing activities by ECO throughout construction phase.</li> <li>» Supervision of all clearing and earthworks.</li> </ul>

**OBJECTIVE: Protection of fauna**

Natural wildlife is common on the site, but species diversity is low – small and medium bovids (springbok, steenbok and duiker), small carnivores (meerkat and aardwolf) along with numerous rodents, birds and reptiles were observed during the course of this study. The presence of faunal species is dictated by the habitats present on and

adjacent to the development site, and includes Strandveld, Sand Fynbos, permanent, seasonal and ephemeral pans, cultivated lands (including the old cultivated areas located on the farm Skaapvlei, and farmhouses, outbuildings and other rural infrastructure), and alien trees (mostly eucalypts and acacias in the areas crossed by both of the proposed routes for the power line running to the east of the proposed development site).

Impacts on terrestrial and avifauna as a result of construction activities are mainly associated with disturbance and habitat destruction.

Project component/s	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
Potential Impact	<ul style="list-style-type: none"> <li>» Vegetation clearance and associated impacts on faunal habitats</li> <li>» Traffic to and from site</li> </ul>
Activity/risk source	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Construction-related traffic</li> <li>» Foundations or plant equipment installation</li> <li>» Mobile construction equipment</li> <li>» Power line construction activities</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To retain natural vegetation in the western corner of the site, where possible.</li> <li>» To minimise footprints of disturbance of vegetation/habitats on-site</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared will be clearly marked in the field to avoid unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation will be kept to a minimum so that impact on flora and fauna is restricted	Contractor	Site establishment & duration of contract
Animals that cannot flee from the affected areas by themselves (e.g. tortoises, amphibians, small mammals) will be removed from the affected areas before the start of site clearing/ construction and relocated these to safe areas	Specialist	Pre-construction
A site rehabilitation programme should be implemented.	Contractor	Duration of contract
A weed eradication programme should be implemented, where necessary.	Contractor	Duration of contract

Performance	» Zero disturbance outside of designated work areas
Indicator	» Minimise clearing of existing vegetation
Monitoring	» Observation of vegetation clearing activities by ECO throughout construction phase.
	» Supervision of all clearing and earthworks.

**OBJECTIVE: Protection of sites of heritage value**

The main cause of impacts to archaeological sites 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 will damage archaeological sites, as will road construction, building foundations and services.

A concentration of small shell middens was recorded at each of two dried springs on the site that were once waterholes with potable water. The contents of the sites are varied – many are ephemeral limpet dominated shell scatters that are visible in what was more recently ploughed land. These middens probably represent short duration camps. At least 3 of the sites are dense middens (even though they are some 3 km from the coast) and included fragments of animal bone. Stone artefacts are present on all sites. The raw materials used are wide ranging – notably quartz, crystal quartz, very high quality silcrete, hornfels, quartzite as well as cryptocrystalline silicates. The assemblages tend to be informal despite the high grades of raw material available. Ceramics are present on many of the waterhole-associated sites indicating that part of the occupation span took place within the last 2 000 years.

Disturbance corridors as well as turbine construction areas and footings will potentially destroy archaeological material. Turbine numbers 29 and 30 in Row B will directly affect an estimated 11 Late Stone Age shell middens; and turbine numbers 61 and 62 in Row C will affect a further 5. The effect of the proposed activities will be the further lateral and vertical disturbance of midden material, destruction of artefactual material and bone and mixing of any preserved stratigraphy.

Project component/s	List of project components affecting the objective:
	» wind energy turbines
	» access roads
	» substation
	» power line

<b>Potential Impact</b>	» Heritage objects or artefacts found on site are inappropriately managed or destroyed.
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Foundations or plant equipment installation</li> <li>» Mobile construction equipment movement on site</li> <li>» Power line construction activities</li> </ul>
<b>Mitigation: Target/Objective</b>	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation.

Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared will be clearly marked in the field to avoid unnecessary disturbance.	Contractor in consultation with Specialist	Pre-construction
Familiarise all staff and contractors with procedures for dealing with heritage objects/sites.	ECO/specialist	Pre-construction
Project employees and any contract staff will maintain, at all times, a high level of awareness of the possibility of discovering heritage sites.	Eskom/Contractor	Duration of contract
If a heritage object is found, work in that area will be stopped immediately, and appropriate specialists brought in to assess and notify the administering authority of the item.	Eskom/Contractor	Duration of contract
Apply for sampling permits from Heritage Western Cape for work on any archaeological sites identified as needing intervention – in other words any archaeological site that will be affected by the access road, crane track, laydown areas, turbine bases and cable trenches.	Eskom	Pre-construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas</li> <li>» All heritage items located are dealt with as per the legislative guidelines</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Due care will be taken during earthworks and disturbance of land by all staff and any heritage objects found will be reported.</li> <li>» Appropriate permits will be obtained from Heritage Western Cape prior to the disturbance or destruction of heritage sites.</li> </ul>

**OBJECTIVE: Protection of wetlands/pans**

Seven small (<1 ha in extent) pans occur on the proposed development site, the largest of these pans being located north of the Skaapvlei road. The pans occur in a matrix of sandy soils, but are formed where the underlying clays come to the surface. The pans

on this site do not appear to support any significantly different natural vegetation, which may be partly a result of disturbance in the form of heavy grazing. However, they have high ecological value, as the only natural open water sources in the area. These pans usually contain water for limited periods, typically during winter and spring, and may support numerous invertebrates, which attract wading birds such as spoonbills, ducks, etc. Many other birds visit the pans when they contain water, but they are usually too saline for frogs.

Drainage lines and other wetland areas are afforded protection by a number of legal instruments in South Africa (including the National Environmental Management Act and the National Water Act). Development planned within these areas, will require approval from the relevant authorities tasked with policing a piece of relevant legislation.

Two small wetlands which may be located within 50 m of a turbine and/or internal access road have been identified on the site (refer to Figure 1). No drainage lines are located on the proposed wind energy facility site, but several are crossed by the proposed power line.

<b>Project component/s</b>	List of project components affecting the objective: » wind energy turbines » access roads » substation » power line
<b>Potential Impact</b>	» Loss of wetland/pan habitat
<b>Activity/risk source</b>	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » Power line construction activities
<b>Mitigation: Target/Objective</b>	» To ensure that any impacts on wetland/riparian habitats are minimised.

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Areas to be cleared will be clearly marked in the field to avoid unnecessary disturbance.	Specialist	Pre-construction
All wetlands, drainage lines and associated buffer zones (viz. 50 m) should be excluded from the development footprint. Where impacts on these features are regarded as unavoidable suitable mitigation measures and offsets will need to be considered.	Eskom/Specialist	Duration of contract

<b>Performance Indicator</b>	» Zero disturbance outside of designated work areas » Impacts on wetlands and drainage lines are minimised
<b>Monitoring</b>	» Observation of site clearing activities by ECO throughout construction phase. » Supervision of all clearing and earthworks.

**OBJECTIVE: Minimisation of visual impacts associated with construction**

The construction phase of the wind energy facility is approximated at roughly two years (one week per turbine) should all 100 turbines be erected. This is dependent on a number of external factors that may not always be controlled. During this time heavy vehicles will frequent the otherwise deserted roads and may cause, at the very least, a visual nuisance to other road users and land owners in the area.

<b>Project component/s</b>	List of project components affecting the objective: » wind energy turbines » substation » power line
<b>Potential Impact</b>	» Temporary visual intrusion
<b>Activity/risk source</b>	» Transportation of wind energy facility and power line components to the site » Construction activities on site and along power line corridor
<b>Mitigation: Target/Objective</b>	» Minimise contrast with surrounding environment and visibility of the construction activities to people in the area » To ensure that the facility complies with Civil Aviation Authority requirements for turbine and power line visibility to aircraft

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The activities and movement of construction workers and vehicles will be restricted to the immediate construction site.	Contractor	Duration of contract
The general appearance of construction activities, construction camps (if required) and lay-down areas will be maintained by means of the timely removal of rubble and disused construction materials.	Contractor	Duration of contract
Construction activities will be restricted to daylight hours (as far as possible) in order to negate or reduce the visual impacts associated with lighting. In the event that night-time construction activities are required to be undertaken, lighting will be placed in such a manner as to limit impacts on the surrounding areas.	Contractor	Duration of contract
Aviation warning lights will be mounted on turbine housing or such measures required by the Civil Aviation Authority	Contractor	Erection of turbines
The turbines will be painted a pale, matt, non-reflective colour (e.g. off white) and that the specified paint colour is complied with before erection of the turbines	Contractor	Erection of turbines

Mitigation: Action/control	Responsibility	Timeframe
Appropriate aircraft markings will be placed on power line conductors, as required	Contractor	Erection of power line
Clearance of vegetation within the development footprint will be minimised	Contractor	Erection of wind energy facility and associated infrastructure

<b>Performance Indicator</b>	No complaints regarding visual intrusion associated with construction activities
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Ensure that aviation warning lights or other measures are installed before construction is completed</li> <li>» Ensure that Aviation warning lights or other measures are functional at all times</li> <li>» Ensure that mitigation measures are implemented during construction to minimise visual impacts on surrounding communities</li> </ul>

**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; resultant from the transport of equipment (including turbine components) and materials and staff to the site during the construction phase 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 wind energy facility and ancillary infrastructure) and works external works outside the site boundary (i.e. road reconstruction/rehabilitation (e.g. Skaapvlei Road), widening intersections, protection/accommodation of existing Eskom, Telkom and other municipal services, protection of existing road related structures etc.).

The expected vehicle movements per day for the transportation of the wind turbine components to the site will be approximately 1 vehicle per day over a 1 year period. It is estimated that 2 570 ready-mix cement truck loads will be required to be transported to the site over a 2 year period for construction of the total facility (including the wind turbine foundations, substation and visitor's centre).

During construction, the access and internal service roads must be upgraded/constructed to support 15 ton axle loads to support the abnormal loads delivering the nacelles, crawler crane and other components. The crawler crane required for the erection of the wind turbines has a tracked width of 11 m when assembled.

The additional construction traffic to the site has the potential to lead to premature failure of access roads, both surfaced and gravel, between the source and the site. The gravel roads may need regular grading to smooth out the surface, but may need to be re-gravelled after completion of the project to restore it to its former condition.

Project component/s	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
Potential Impact	<ul style="list-style-type: none"> <li>» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted.</li> <li>» Risk of accidents</li> <li>» Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads</li> <li>» Generation of dust and noise from increased vehicles moving on Skaapvlei road</li> </ul>
Activity/risk source	<ul style="list-style-type: none"> <li>» Traffic congestion increase at the Skaapvlei road/R363 intersection.</li> <li>» Increased traffic movement (especially heavy/abnormal load vehicles) on Skaapvlei road</li> <li>» Traffic congestion from abnormal weight or sized loads from Cape Town to the site</li> <li>» Site preparation and earthworks</li> <li>» Foundations or plant equipment installation</li> <li>» Transportation of ready-mix cement from off-site batching plant</li> <li>» Mobile construction equipment movement on site</li> <li>» Power line construction activities</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To minimise impacts of traffic associated with the construction of the wind energy facility on local traffic.</li> <li>» To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction.</li> <li>» To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions.</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
A detailed assessment of road transport routes and vehicles through the preparation and implementation of a separate Traffic Management Plan for the construction phase will be undertaken.	Transportation contractor appointed by the wind turbine supplier	Pre-construction
All relevant permits for abnormal loads will be applied for from the relevant authority	Transportation contractor appointed by the wind turbine supplier	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
Appropriate road management strategies will be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures. A management plan will be submitted for Eskom's acceptance.	Appointed transportation contractor	Pre-construction
Appropriate dust suppression techniques will be used to minimise dust emissions	Contractor	Duration of contract
Vehicle movements on local roads will be limited to standard construction operating hours wherever possible to limit noise impacts and nuisance.	Contractor	Duration of contract
Arrival and departure of heavy vehicles will be co-ordinated to minimise congestion on the local R363 road.	Contractor	Duration of contract
A designated access to the proposed site will be created to ensure safe entry and exit.	Contractor	Pre-construction
Signage will 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
All hazardous substances will be transported in accordance with the relevant legislation and regulations	Contractor	Duration of contract
Any traffic delays as a result of construction traffic will be co-ordinated with the appropriate authorities	Contractor	Duration of contract
Appropriate maintenance of all vehicles will be ensured	Contractor	Duration of contract
All vehicles travelling on public roads will adhere to the specified speed limits and all drivers will be in possession of an appropriate valid driver's license	Contractor	Duration of contract
The movement of all vehicles within the site will be on designated roadways.	Contractor	Duration of contract
No deviation from approved transportation routes will be allowed, unless roads are closed for whatever reason outside the control of the contractor.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No traffic incidents involving Eskom personnel or contractors.</li> <li>» No complaints resulting from traffic associated with construction of the wind energy facility.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Visual monitoring of dust produced by traffic in order to minimise dust emissions.</li> <li>» Visual monitoring of traffic control measures to ensure they are effective.</li> <li>» 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.</li> </ul>

**OBJECTIVE: Appropriate handling and management of waste**

The construction of the wind energy facility will involve the generation of various wastes. In order to manage the wastes effectively, guidelines for the assessment, classification and management of wastes, along with industry principles for minimising construction wastes must be implemented.

The main wastes expected to be generated by the construction of the wind energy facility will include:

- » general solid waste
- » hazardous waste
- » liquid waste

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» access roads</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Inefficient use of resources resulting in excessive waste generation</li> <li>» Litter or contamination of the site or water through poor waste management practices.</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Packaging</li> <li>» Other construction wastes</li> <li>» Spoil material from excavation, earthworks and site preparation</li> <li>» Hydrocarbon use and storage.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To comply with waste management guidelines</li> <li>» To minimise production of waste</li> <li>» To ensure appropriate waste disposal</li> <li>» To avoid environmental harm from waste disposal</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Packaging will be minimised. Suppliers will be advised of waste minimisation expectations.	Contractor	Duration of contract
Where possible, construction and general wastes on site will be reused or recycled. A recycling plan should be developed in accordance with the requirements of the National Waste Management Strategy.	Contractor	Duration of contract
Bins and skips will be available on site for collection and storage of wastes will be separated into the various recycling categories such as wood, metals, general refuse etc. The Contractor will submit a recycling specification for Eskom's approval. Refer to Appendix A	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
for recycling guidelines.		
Specific areas will 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 will seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control	Contractor	Duration of contract
Disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors	Contractor	Duration of contract
Construction contractors will provide specific detailed waste management plans	Contractor	Duration of contract
Hydrocarbon waste will be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Uncontaminated waste will be removed at least weekly for disposal; other wastes will be removed for recycling / disposal at an appropriate frequency	Contractor	Duration of contract
Waste and surplus dangerous goods will be kept to a minimum and will be transported by approved waste transporters to sites designated for their disposal	Contractor	Duration of contract
Documentation (waste manifest) will be maintained detailing the quantity, nature and fate of any regulated waste	Contractor	Duration of contract
Sewage: Regularly serviced chemical toilets will be used	Contractor	Duration of contract
Establish and maintain an incident/complaints register	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints received regarding waste on site or indiscriminate dumping</li> <li>» Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately</li> <li>» Provision of all appropriate waste manifests</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of waste management practices throughout construction phase.</li> <li>» Waste collection will be monitored on a regular basis</li> <li>» Waste documentation completed</li> <li>» 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.</li> </ul>

**OBJECTIVE: Appropriate handling and storage of chemicals and hazardous substances**

The construction phase of the wind energy facility will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. Chemical storage is likely to occur within the substation site and workshop area.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Release of contaminated water from contact with spilled chemicals.</li> <li>» Fuel source for on-site fires</li> <li>» Generation of contaminated wastes from used chemical containers.</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Power line construction activities</li> <li>» Substation</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure that the storage and handling of chemicals and hydrocarbons on site does not cause pollution to the environment or harm to persons</li> <li>» To ensure that the storage and maintenance of machinery on site does not cause pollution of the environment or harm to persons</li> </ul>

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bundled	Contractor	Duration of Contract
Any spills will receive the necessary clean-up action. Bioremediation kits to be kept on site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with the Waste Management Plan of this EMP)	Contractor	Duration of Contract
Spill response training will be included for all staff and contractors as part of site induction	Contractor	Duration of Contract
Any storage and disposal permits/approvals which may be required will be obtained and the conditions attached to such permits and approvals will be compiled with	Contractor	Duration of Contract
Servicing and maintenance of vehicles will not to take place on site unless in an emergency situation. If repairs of vehicles must take place, a drip tray will be used to contain any fuel or oils	Contractor	Duration of Contract
Transport of all hazardous substances will be in	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
accordance with the relevant legislation and regulations		Contract
MSDS records to be kept current for chemicals in use	Contractor	Duration of Contract
Waste disposal records will be available for review at any time.	Contractor	Duration of Contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No chemical spills outside of designated storage areas.</li> <li>» No water or soil contamination by chemical spills</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase.</li> <li>» 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.</li> </ul>

**OBJECTIVE:** Ensure disciplined operation of on site contractors

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.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy turbines</li> <li>» substation</li> <li>» power line</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Pollution/contamination of the environment</li> <li>» Disturbance to the environment</li> </ul>
<b>Activity/risk source</b>	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
<b>Mitigation: Target/Objective</b>	» 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 will be included in all tender documentation and Contractors contracts.	Eskom	Tender process
No personnel other than night watchmen and shift security will be permitted to remain on the site	Contractor/s and sub-contractor/s	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
overnight.		
Contractors will use chemical toilet situated in a designated area of the site; no personal hygiene (e.g. washing) will be permitted outside the designated area. These toilets will be regularly serviced by appropriate contractors.	Contractor/s and sub-contractor/s	Duration of contract
Cooking/meals will take place in a designated area; no firewood or kindling may be gathered from the site or surrounds	Contractor/s and sub-contractor/s	Duration of contract
All litter will 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/s and sub-contractor/s	Duration of contract
No one other than the ECO or personnel authorised by the ECO, will disturb or pick plants outside the demarcated construction area	Contractor/s and sub-contractor/s	Duration of contract
No one other than the ECO or personnel authorised by the ECO, will disturb animals on the site (no trapping, shooting etc.)	Contractor/s and sub-contractor/s	Duration of contract
Animals disturbed during construction activities should not be harmed but should be allowed to move off to an undisturbed area of the site	Contractor/s and sub-contractor/s	Duration of contract

<b>Performance Indicator</b>	Check compliance with specified conditions
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of Contractor practices throughout construction phase.</li> <li>» 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.</li> </ul>

## 5.2. Institutional Arrangements: Roles and Responsibilities for the Construction Phase of the Wind Energy Facility

**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 and Environmental Officer for the construction phase of this project are as detailed below.

The **Project Manager** will:

- » Ensure of all specifications, legal constraints and Eskom standards and procedures pertaining to the project specifically with regards to the environment is highlighted to Eskom that Eskom and its Contractor(s) so that they are aware of this.
- » Ensure that Eskom 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 conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Eskom's Representative) will:

- » Be fully knowledgeable with the contents of the Environmental Impact Assessment.
- » Be fully knowledgeable with the contents and conditions of the RoD (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 Eskom environmental policies and procedures, and ensure compliance with these.
- » Have overall responsibility of the EMP and its proper implementation.
- » Conduct audits to ensure compliance to the EMP.
- » Ensure there is communication with the Project Manager or his delegate, the Environmental 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** will:

- » Be fully knowledgeable with the contents with the Environmental Impact Assessment.
- » Be fully knowledgeable with the contents with the conditions of the RoD (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 Eskom environmental policies and procedures, and ensure compliance with them.
- » Ensure that the contents of this document are communicated to the Contractor site staff and that Project 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 subcontractors and staff) and service providers are ultimately responsible for:

- » Ensuring adherence to the environmental management specifications;
- » Ensuring that Methods Statements are submitted to the 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 Engineer/Project Manager on the advice of the ECO are adhered to.
- » Ensuring that there must be communication tabled in the form of a report 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 the transgressions issued by the ECO.
- » Ensuring that a register of all public complaints is maintained.
- » Ensure that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute to wards the successful implementation of the EMP.

### **5.3. Awareness and Competence: Construction Phase of the Wind Energy Facility**

**OBJECTIVE:** To ensure all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and ongoing minimisation of environmental harm.

To achieve effective environmental management, it is important that employees, Contractors and Subcontractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. Environmental training may typically include the following:

- » Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.
- » Basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.
- » Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- » Records must be kept of those that have completed the relevant training.

### **5.4. Monitoring Programme: Construction Phase of the Wind Energy Facility**

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

A monitoring programme will 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. Eskom will stipulate the period and frequency of monitoring required. This will be determined in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is carried out.

The Environmental Control Officer will ensure compliance with the EMP, and to conduct monitoring activities. The Environmental Control Officer must have the appropriate experience and qualifications to undertake the necessary tasks. The Environmental Control Officer will report to the Environmental Monitoring Committee and Site Manager should any non-compliance be evident or corrective action necessary.

**MANAGEMENT PLAN FOR WIND ENERGY FACILITY:  
 REHABILITATION OF DISTURBED AREAS**

**CHAPTER 6**

**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

In order to meet this goal, the following objectives, actions and monitoring requirements is relevant:

**OBJECTIVE:** To ensure 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. The main areas thus requiring rehabilitation will be parts of the laydown areas next to the turbines, the crane tracks alongside the permanent 6m roads, any cable routings where these fall outside the abovementioned areas, and disturbed areas around the planned visitor centre and substation.

Project component/s	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility (including access roads and laydown areas)</li> <li>» power line servitude and service road for power line servitude</li> </ul>
Potential Impact	<ul style="list-style-type: none"> <li>» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention</li> </ul>
Activity/risk source	<ul style="list-style-type: none"> <li>» Laydown areas</li> <li>» Access roads</li> <li>» Other disturbed areas</li> </ul>
Mitigation: Target/Objective	<ul style="list-style-type: none"> <li>» To ensure and encourage site rehabilitation of disturbed areas</li> <li>» To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts are remediated or curtailed</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
All temporary facilities, equipment and waste materials will be removed from site	Contractor	Following execution of the works
Compacted areas that are no longer needed after construction (e.g. parts of the laydown areas, and the crane tracks) will be ripped and scarified	Contractor	Following completion of construction activities in an area
Stockpiled topsoil will be replaced to a depth of at least 10 cm. Topsoil will not be respread while conditions are very wet or very dry.	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures will be installed, where required	Contractor	Following completion of construction activities in an area
Mulched local plant material (from site clearing activities) or appropriate fertiliser will be scattered on top of the areas to be rehabilitated.	Contractor	Following completion of construction activities in an area
Disturbed areas will be re-vegetated with appropriate natural vegetation and/or local seed mix. Sowings will occur where practicable at the most appropriate time to assist in the success of the ground cover	Contractor	Following completion of construction activities in an area
Re-vegetated areas will be maintained until an acceptable cover has been achieved	Eskom	Post-rehabilitation
All livestock will be removed from the site until rehabilitated area has established (up to 15 years).	Eskom	Post-rehabilitation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities</li> <li>» Topsoil replaced on all areas, and stabilised</li> <li>» Disturbed areas rehabilitated</li> <li>» Acceptable cover achieved on closed site</li> <li>» Closed site free of erosion and alien invasive plants</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented.</li> <li>» Ongoing alien plant monitoring and removal should be undertaken on an annual basis</li> </ul>

**MANAGEMENT PLAN FOR WIND ENERGY FACILITY:  
 OPERATION**

**CHAPTER 7**

**7.1. Overall Goal for Operation**

**Overall Goal for Operation:** To ensure that the operation of the wind 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 wind energy facility in a way that:

- » Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
- » Enables the wind 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 wind energy facility on birds that frequent the area, in particular monitoring of bird strikes, bird nesting activities and water bird uses of the wetlands/ephemeral pans on the site.
- » Monitors the actual noise impacts of the wind energy facility.
- » Establishes an environmental baseline for wind energy facility sites in South Africa, particularly with regard to priority bird species using the site.

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

**OBJECTIVE:** Protection of vegetation

Indirect impacts on vegetation during operation could result from maintenance activities and the movement of people and vehicles on site.

Project component/s	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility (including access roads)</li> <li>» substation and access to substation</li> <li>» power line and service road for power line servitude</li> </ul>
Potential Impact	» Disturbance to or loss of vegetation and/or habitat
Activity/risk source	» Movement of employee and visitor vehicles within and around site
Mitigation: Target/Objective	» To retain natural vegetation in the western corner of the site, where possible.

	<ul style="list-style-type: none"> <li>» To maintain minimised footprints of disturbance of vegetation/habitats on-site</li> <li>» To ensure and encourage rehabilitation</li> </ul>
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Mitigation: Action/control	Responsibility	Timeframe
Vehicle movements will be restricted to designated roadways	Eskom	Operation
No new roads will be created	Eskom	Operation
A site rehabilitation programme should be implemented.	Eskom	Operation
A weed eradication programme should be implemented, where necessary.	Eskom	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No further disturbance to vegetation</li> <li>» Continued improvement of rehabilitation efforts</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation on-site by Site Manager.</li> <li>» Regular inspections to monitor rehabilitation efforts and weed infestation (6-12 monthly).</li> </ul>

**OBJECTIVE: Maintenance of rehabilitated areas**

In order to ensure the long-term environmental integrity of the site following construction, maintenance the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility (including access roads and laydown areas)</li> <li>» power line servitude and service road for power line servitude</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Laydown areas</li> <li>» Access roads</li> <li>» Other disturbed areas</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure and encourage site rehabilitation of disturbed areas</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
A botanist familiar with the vegetation of the area should monitor the rehabilitation success on an annual basis in August or September, and make recommendations on how to improve any problem areas	Eskom/Specialist	Annual monitoring until successful re-establishment of vegetation in an area
Remove all livestock from the site until rehabilitated area has established	Eskom	Operation (up to 15 years following the completion of construction)

Performance Indicator	» Successful rehabilitation of disturbed areas.
Monitoring	<ul style="list-style-type: none"> <li>» Monitoring of the rehabilitation success on an annual basis in August or September</li> <li>» Ongoing alien plant monitoring and removal should be undertaken on an annual basis</li> </ul>

**OBJECTIVE:** Protection of avifauna and determine the impact of the operating wind energy facility on priority bird species

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. Unlike more problematic wind energy facilities identified in other parts of the world, the proposed wind energy facility is not positioned overly close to any known avian fly-ways, and does not otherwise impose on a particularly bird-rich environment, so it is unlikely to result in significant numbers of avian casualties through collision with the turbine blades, or cause undue loss of habitat or disturbance to any locally, regionally or nationally important bird populations. However, it is essential that the bird interactions which do take place with the establishment of the facility are fully documented, and that every opportunity to learn about birds and their interactions with wind energy facilities in the South African environment is fully exploited.

Project component/s	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility (turbines)</li> <li>» power line</li> </ul>
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<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Disturbance to or loss of birds as a result of collision with the turbine blades or overhead power line</li> <li>» Electrocutation as a result of power line</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Spinning turbine blades</li> <li>» Overhead high tension power line</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» More accurately determine the impact of the operating wind energy facility on priority bird species</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Bird-friendly power line tower and conductor designs will be used.	Eskom Distribution	Erection and maintenance of power line
Bird-flappers will be fitted to aerial cabling, where required by a suitably qualified ornithologist	Eskom Distribution/ specialist	Erection and maintenance of power line
A site monitoring programme will be implemented for surveying bird movements in relation to the wind energy facility and fully documenting all collision casualties.	Eskom/specialist	Operation
An on-site monitor of bird turbine collision incidents will be designated for the duration of the operating phase	Eskom/specialist	Operation
An ornithologist will be designated to provide input on monitoring and mitigation of bird collisions. Report all bird collisions to designated ornithologist	Eskom/specialist	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No further disturbance to avifaunal populations on the site</li> <li>» Continued improvement of avifaunal protection efforts</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades or power lines</li> <li>» Regular inspections to monitor casualties from collisions - Delegate a suitable on-site monitor to assess avian mortality associated with the facility</li> <li>» Record all bird casualties that occur on-site as a result of turbine collisions, with accurate information on where, when and how collisions take place, and report all recorded incidents to the designated ornithologist.</li> </ul>

**OBJECTIVE: Protection of terrestrial fauna**

Indirect impacts on terrestrial fauna during operation could include disturbance and further habitat destruction as a result of maintenance activities and the movement of people and vehicles on site.

Bat mortality at wind energy plants has been reported world-wide. Bats occurring in the area may potentially suffer mortality from the rotor blades of the turbines when these animals forage at night. Excessive lighting at the facility may attract flying insects and therefore also bats, which may lead to increased mortality.

<b>Project component/s</b>	List of project components affecting the objective: » wind energy facility (including access roads) » substation and access to substation » power line and service road for power line servitude
<b>Potential Impact</b>	» Disturbance to or loss of fauna and/or habitat
<b>Activity/risk source</b>	» Movement of employee and visitor vehicles within and around site
<b>Mitigation: Target/Objective</b>	» To keep number of vehicle movements to a minimum » To maintain minimised footprints of disturbance of vegetation/habitats on-site » To minimise impacts on bats » To ensure and encourage site rehabilitation

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Vehicle movements restricted to designated roadways	Eskom	Operation
Excessive lighting at the facility should be avoided	Eskom/specialist	Erection and maintenance of facility

<b>Performance Indicator</b>	» No further disturbance to faunal populations on the site » Continued improvement of faunal protection efforts
<b>Monitoring</b>	» Observation of faunal populations and incidence of road kill on site access roads by Site Manager. » Observation and recording of bat mortality associated with the wind energy facility

**OBJECTIVE: Minimisation of visual impacts**

The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the natural viewshed of this region imposed by the components of the facility. Potentially uninterrupted exposure of the facility is largely contained within the 25 km buffer zone of the site. The majority of potentially uninterrupted exposure occurs within the 0 – 10 km zone. Visibility beyond the 25 km mark becomes scattered and broken and ultimately negligible as it nears the 50 km buffer distance.

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. 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.

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

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility (including access roads)</li> <li>» Substation</li> <li>» power line and service road for power line servitude</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Risk to aircraft in terms of the potential for collision</li> <li>» Enhanced visual intrusion</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Size/scale of turbines</li> <li>» Substation and associated lighting</li> <li>» Access roads</li> <li>» Power line</li> <li>» Other associated infrastructure (e.g. visitor's centre)</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To minimise potential for visual impact</li> <li>» To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft</li> <li>» Minimise contrast with surrounding environment and visibility of the turbines to humans</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Aviation warning lights will be mounted on turbine hub or such measures required by the Civil Aviation Authority	Eskom	Erection and maintenance of facility
The turbines will be painted a pale, matt, non-reflective colour (e.g. light grey) and that the specified paint colour is complied with before erection of the turbines	Eskom	Erection and maintenance of facility
Use of light fixtures and the fitment of covers and shields will be designed to contain rather than spread light	Eskom	Erection and maintenance of facility
Appropriate aircraft markings will be placed on power line conductors, as required	Eskom Distribution	Erection and maintenance of power line

<b>Performance Indicator</b>	» Minimised visual impact on surrounding areas
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Ensure that aviation warning lights or other measures are installed before construction is completed</li> <li>» Ensure that Aviation warning lights or other measures are functional at all times</li> </ul>

**OBJECTIVE:** Monitor the noise produced by the wind energy facility and its effects on local residents

The results of the noise impact assessment undertaken as part of the EIA indicate that there would be no impact of outdoor noise emanating from the wind turbines at the nearest noise sensitive area, Skaapvlei, and at all other noise sensitive land. However, low-frequency noise emanating from the turbines might have a low negative impact of low significance within dwellings at Skaapvlei.

<b>Project component/s</b>	List of project components affecting the objective: <ul style="list-style-type: none"> <li>» wind energy facility</li> </ul>
<b>Potential Impact</b>	» Noise from the turbines and other infrastructure on the site causes a disturbance to local residents, which cannot be mitigated.
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Turbines</li> <li>» Substation</li> </ul>
<b>Mitigation: Target/Objective</b>	» To confirm that noise levels generated by the facility are within or below the levels predicted by the noise specialist in the EIA.

Mitigation: Action/control	Responsibility	Timeframe
Services (for example, delivery of construction materials or turbine components) will be scheduled so that there is minimal vehicle movement/congestion outside of working hours.	Eskom	Operation

<b>Performance Indicator</b>	» Noise levels monitored are within or below the levels predicted by the noise specialist in the EIA
<b>Monitoring</b>	» Follow-up noise measurements should be conducted under different weather and wind conditions (to be determined by the noise specialist) over the first year of operation

**OBJECTIVE: Appropriate handling and management of hazardous substances and waste**

The operation of the wind energy facility will involve the generation of limited waste products. The main wastes expected to be generated by the operation activities include:

- » general solid waste
- » hazardous waste
- » liquid waste

<b>Project component/s</b>	List of project components affecting the objective: » wind energy turbines » substation
<b>Potential Impact</b>	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
<b>Activity/risk source</b>	» Office and workshop facilities » Generators and gearbox - turbines » Transformers and switchgear - substation » Water storage tank » Fuel and oil storage
<b>Mitigation: Target/Objective</b>	» 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.	Eskom	Operation

Mitigation: Action/control	Responsibility	Timeframe
Storage areas for hazardous substances must be appropriately sealed and bunded	Eskom	Establishment and operation of facility
All structures and/or components replaced during maintenance activities will be appropriately disposed of at an appropriate DWAF licensed waste disposal site or sold to a recycling merchant for recycling.	Eskom	Operation
Care will be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Should any accidental spillage take place, it will be cleaned up according to specified standards regarding bioremediation.	Eskom	Operation
Waste handling, collection and disposal operations will be managed and controlled by a waste management contractor	Eskom/waste management contractor	Operation
Wastewater: Water from bunds and oily water from oil/water separator will be removed by a licensed contractor.	Eskom/waste contractor	Operation
Waste – Leaked oil and chemicals: » Appropriate disposal will be arranged with a licensed facility in consultation with the administering authority » Waste will be stored and handled according to the relevant legislation and regulations.	Eskom/waste management contractor	Operation
General waste will be recycled where possible or disposed of at an appropriately licensed landfill	Eskom/waste management contractor	Operation
Hazardous waste (including hydrocarbons) and general waste will be stored and disposed of separately	Eskom/waste management contractor	Operation
Regularly serviced chemical toilets will be used on site.	Eskom/waste management contractor	Operation
Disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors	Eskom	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints received regarding waste on site or indiscriminate dumping</li> <li>» Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately</li> <li>» Provision of all appropriate waste manifests</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Waste collection must be monitored on a regular basis.</li> <li>» Waste documentation must be completed and available for inspection on request</li> </ul>

- » 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 management representative. All appropriate waste disposal certificates accompany the monthly reports.

## 7.2. Functions and Responsibilities for the Operational Phase of the Wind Energy Facility

The **Generation Environmental Manager** will:

- » Provide overall assurance to the MD: Generation Division (and hence ultimately the CEO) that environmental issues are appropriately addressed and managed at the various business units (= power generation stations).
- » Develop and implement strategies on various issues such as Environmental Management Systems, waste management, etc.
- » Be responsible for overall consolidation and reporting of environmental performance within the Generation Division.
- » Liaise on a strategic level with Government and other stakeholders on a range of issues.

The **Wind Energy Facility Power Station Manager** will:

- » Identify and appoint representatives from different departments of the facility. These employees shall be assigned the role of EMP drivers and shall collectively form the EMS management team with the environmental practitioner.
- » Ensure that adequate resources (human, financial, technology) are made available for the successful implementation and operation of the EMS.
- » Conduct annual basis reviews of the EMS to evaluate its effectiveness.
- » Take appropriate action as a result of findings and recommendations in management reviews and audits.

The **Environmental Officer** will:

- » Implement an Environmental Management System (EMS) for the facility including the associated infrastructure.
- » Manage and report on the facility's environmental performance.
- » Conduct internal environmental audits and co-ordinate external environmental audits.
- » Liaise with statutory bodies such as DEAT and DEA&DP on environmental performance and other issues.
- » Conduct environmental training and awareness for the employees who maintain the Wind Energy Facility.
- » Compile environmental policies and procedures.

- » Liaise with interested and affected parties on environmental issues of common concern.

## MANAGEMENT PLAN FOR WIND ENERGY FACILITY: DECOMMISSIONING

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## CHAPTER 8

The turbine infrastructure which will be utilised for the proposed wind energy facility is expected to have a lifespan of 20 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 discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

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

### **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 Turbine**

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

## APPENDIX A

### GUIDELINES FOR THE SEPARATION OF CONSTRUCTION WASTE

The most important step for recycling of construction waste is on-site separation. Initially, this will take some extra effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

#### GUIDELINES

##### 1. What to Recycle

Before recycling construction waste, identify who will accept it. This is important in designating type of waste to separate, and in making arrangements for drop-off or delivery of materials. Materials that can be recycled include:

- » Cardboard and Paper
- » Wood
- » Metals
- » Plastics
- » Glass
- » Paints, Stains, Solvents and Sealants
- » Oil

##### 2. Materials Separation

Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

Some materials will require bins or storage that protect these from rain. Other bins may be locked to prevent tampering.

##### 3. Recycling and Waste Minimisation Guidelines

- » *Wood*
  - \* Optimise building dimensions to correspond to standard wood dimensions in order to reduce the need for cutting.
  - \* Store wood on level blocking under cover to minimize warping, twisting and waste.

- » *Metals*
  - \* During construction, separate metals for recycling, including copper piping, wire; aluminum,; iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.
  
- » *Cardboard and Paper*
  - \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  - \* As far as possible, use recyclable packaging.
  - \* Separate cardboard waste, bundle, and store in a dry place.
  - \* Minimise the number of blueprints and reproductions necessary during the design and construction process.
  
- » *Plastic*
  - \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  - \* As far as possible, use recyclable packaging.
  
- » *Paints, Stains, Solvents and Sealants*
  - \* Unused materials should be taken to a hazardous waste collection facility.

Sources:

<http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines>  
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