ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED 315 MW PHEZUKOMOYA WIND ENERGY FACILITY AND GRID CONNECTION, NORTHERN AND EASTERN CAPE PROVINCES

On behalf of

PHEZUKOMOYA WIND POWER (PTY) LTD

January 2018

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

Office 220 Cube Workspace
Icon Building
Cnr Long Street and Hans Strijdom Avenue
Cape Town
8001

T +27 (0) 21 412 1529 l **E** AshlinB@arcusconsulting.co.za
W www.arcusconsulting.co.za

Registered in South Africa No. 2015/416206/07

Glossary of Terms

Construction Phase: The activities pertaining to the preparation for and the physical construction of the proposed development

Contractor: Persons/organisations contracted by the Developer to carry out parts of the work for the proposed project

Engineer / Project Director (PD): Person/organisation appointed by the Developer to oversee the work of all consultants, sub-developers, contractors, residents and visitors.

Environment: The environment is defined as the surroundings within which humans exist and that are made up of – the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any part or combination of (i) and (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental and Social Manager (ESM) also known as the Environmental Control Officer (ECO): Person/organisation appointed by the Developer who will provide direction to the Principal Agent concerning the activities within the Construction site. The ECO will also be responsible to liaise with the independent auditor who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme.

Independent Auditor: The person or entity who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme and Environmental Authorisation.

Environmental Management Programme (EMP): The EMP is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMP contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMP specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

Therefore the EMP will be a working document, which will be reviewed when necessary, or if required by the authorities. A revision will be done once the detailed design of the proposed development has been completed.

Operational Phase (Post Construction): The period following the Construction Phase, during which the proposed development will be operational.

Pre-Construction Phase: The period prior to commencement of the Construction Phase, during which various activities associated with the preparation for the Construction Phase: detailed final designs, micro siting, etc. will be undertaken.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the insurance of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired

way, i.e. promote rapid vegetation establishment.

Site Manager: The person, representing the Contractor, responsible for all the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction Phase.

Project Area: This refers to the authorised area for the proposed development to take place. Farm portions numbers are outline in the EMP.

Local Community: People residing or present in the region and near the construction activities, including the owners and/or managers of land affected by construction, workers on the land, and people in nearby towns and villages.

Public: Any individual or group concerned with or affected by the Project and its consequences, including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.

Construction Area / Site: The land on which the Project is to be located. It includes the site, construction campsite, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMP (particularly the specifications for rehabilitation) is relevant for all areas disturbed during construction.

Access Roads and Tracks: All newly established roads and tracks, and areas cleared or driven over to provide access to/from the construction areas, and for the transportation of the construction workforce, equipment and materials.

Environmental Impact: The effect of an activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution of, or detriment to the environment, or in danger to the public, whether immediate or delayed.

Environmental Incident: An unexpected or sudden occurrence related to the Project, including major emissions, spills, fires, explosions, floods or erosion leading to serious or potentially serious negative environmental impacts.

Fugitive Dust: Can be defined as natural and/or human-associated dust becoming airborne due to the forces of wind or human activity.

Fauna and Flora / Plants and Animals: Any individual or group of micro-organisms, plants or animals.

General Waste and Construction Rubble It includes waste paper, board, cardboard, benign organic and domestic waste and uncontaminated construction debris such as used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Heritage Sites and Artefacts: Heritage sites and artefacts can be defined as any object or site of cultural, historical, archaeological or palaeontological significance found in or on the land. Historical objects are objects older than 50 years with architectural, historical, scientific, cultural, social, spiritual, linguistic, technological or aesthetic value. For example: buildings or parts thereof, graves or burial sites, milestones, numismatic objects (i.e. coins and beads), and military objects.

Archaeological objects include material remains resulting from human activity which are older than 100 years and which are in a state of disuse, such as tools, artefacts, human and hominoid remains and artificial features and structures.

Palaeontological objects include any fossilised remains of animals or plants.

Hazardous Substances: Substances which are potentially dangerous and may affect human and/or environmental health. This would be because of the substances' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste includes, but is not limited to: human excrement, the by-products and wastes associated will the use of hazardous substances (i.e. used fuel, oil, lubricants and solvents), as well as items such as spent batteries, old oil filters, light bulbs, tyres, circuit boards, etc. which requires special collection and handling. When left abandoned, even substances such as scrap metal, wire, tins, broken glass and plastic could be harmful to people, wild and domestic animals. For example: plastic could be ingested by animals; people and animals could be injured by broken glass or metal objects; and animals could get trapped in drums, tins and bottles or get entangled in plastic or metal wiring. Even if buried, such objects may become exposed over time due to wind erosion, scavengers or future human activities. Because of the sensitive nature of the area, these substances are all regarded as 'hazardous waste' for the purposes of this EMP.

Hydrological Features: Hydrological features include, but are not limited to:

- wetlands;
- open water;
- vegetated drainage channels;
- subterranean water;
- marine environments;
- estuarine environments.

Life Support Systems: Life support systems include, but are not limited to: an ecological system in which its outputs are vital for sustaining specialised habitats; an ecological system in which its outputs are vital for sustaining human life (e.g. water purification).

Mitigation: Environmental management measures designed to avoid, limit or remedy undesirable environmental impacts.

Monitoring: Structured observation, measurement and evaluation of environmental data over a period of time to assess the efficiency of environmental mitigation and rehabilitation measures.

Rehabilitation: Measures implemented to restore a damaged Environment.

Sensitive Sites: Environmentally sensitive sites include, but are not limited to:

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;
- Areas particularly prone to erosion once disturbed (i.e. steep slopes);
- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

Specialised habitats: Specialised habitats include, but are not limited to, areas which are:

- Priority breeding habitats;
- Refuge areas;
- Vital for species survival (important for, part, or all of its life cycle);
- Essential for species performance;
- Cryptic habitats, etc.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Phezukomoya Wind Power (Pty) Ltd are applying for environmental authorisation to construct the Phezukomoya 315 MW wind energy facility (WEF) and its associated infrastructure, including a 132 kV grid connection (the proposed Phezukomoya WEF) (Figure 1).

This document must be seen as dynamic, and be updated when and if required, throughout the lifecycle of the project.

The Environmental Management Plan (EMP) outlines measures to be implemented in order to minimise adverse environmental degradation associated with construction of the proposed development. It serves as a guide for the contractor and the construction workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction period.

1.2 Details of the Applicant and the Environmental Assessment Practitioner

Details of Applicant	
Project Applicant	Phezukomoya Wind Power (Pty) Ltd
Company Registration	2012/185566/07
Contact Person	Louis Dewavrin
Postal Address	PO Box 71664, 6000
Telephone	0415064910
Fax	
Email	ldewavrin@innowind.com

Environmental Assessment Practitioner	
EAP	Arcus Consultancy South Africa Services (Pty) Ltd
Contact Person	Ashlin Bodasing
Qualifications	Bachelor of Social Science (Geography and Environmental Management)
Postal Address	
Telephone	021 412 1529
Fax	None
Email	phezukomoya@arcusconsulting.co.za

1.3 Purpose and Aims of this Document

An Environmental Management Programme (EMPr) for the proposed development is required in terms of the following documents:

- 2014 Regulations in terms of Chapter 5 of the National Environmental Management Act (1998, as amended).

As per the Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning (DEA&DP) Guideline for Environmental Management Plans (Lochner 2005) the over-arching objectives of an EMP are (1) to ensure compliance with regulatory authority stipulations and guidelines, (2) to ensure sufficient allocation of resources on the project budget, (3) to verify environmental performance through information on impacts as they occur, (4) to respond to changes in project implementation not considered in the EIA, (5) to respond to unforeseen events and (6) to provide feedback for continual improvement in environmental performance.

The aim of this Environmental Management Programme is to achieve the above objectives by:

- Defining the environmental management objectives to be realised during the life of the project, in order to enhance benefits and minimise adverse environmental impacts;
- Describing detailed actions needed to achieve these objectives, and mechanisms that address changes in the project implementation, emergencies and unexpected events;
- Clarifying institutional structures, roles, communication and reporting processes;
- Describing the link between the EMPr and associated legislated requirements; and
- Describing requirements for record keeping, reporting, review, auditing and updating of the EMPr.

1.4 The Proposed Project

The proposed 315 MW Phezukomoya WEF would consist of the following infrastructural components:

- Up to 63 wind turbines with a generation capacity between 3 – 5 MW and a rotor diameter of up to 150 m, a hub height of up to 150 m and blade length of up to 75 m;
- Foundations (up to 25 x 25 m) and hardstands associated with the wind turbines;
- Internal access roads of between 8 m (during operation) and 14 m (during construction) wide to each turbine;
- Two on-site switching stations (10 000 m^2);
- Medium voltage cabling between turbines and the switching stations, to be laid underground where technically feasible;
- Overhead medium voltage cables between turbine rows where necessary;
- An on-site sub-station operations and maintenance complex (180 000 m^2) to facilitate stepping up the voltage from medium to high voltage (132 kV) to enable the connection of the WEF to the national grid;
- A 16 km 132 kV voltage overhead power line from the on-site sub station to the proposed Umsobomvu Substation to the national grid;
- Temporary infrastructure including a site camp; and
- A laydown area approximately 7500 m^2 in extent, per turbine.

The total size of the land portions within which the proposed development will be located is 15 271 hectares (Figure 2). The footprint of the proposed development is estimated to be less than 1% of this area.

1.5 Proposed Project Infrastructure Components

The proposed project will comprise the following components as described below. It should be noted as the final design of the proposed project is not yet finalised, all dimensions are maximums as is required by the EIA process. The final design may include infrastructure which is of equal or less than dimensions to those stated below but not more than.

1.5.1 Turbines

The proposed project will consist of up to 63 turbines. At this stage it is envisaged that the turbines will each have a capacity to generate between 3 and 5 MW and blade length of up to 75 m. The turbines will be three-bladed horizontal-axis design with a hub height of up to 150 m and a rotor diameter of up to 150 m. A typical wind turbine is presented below (Plate 1). The exact turbine model has not been selected yet and will be subject to competitive tendering after further wind analysis has been completed. The turbine model will depend upon the technical, commercial and site specific requirements.

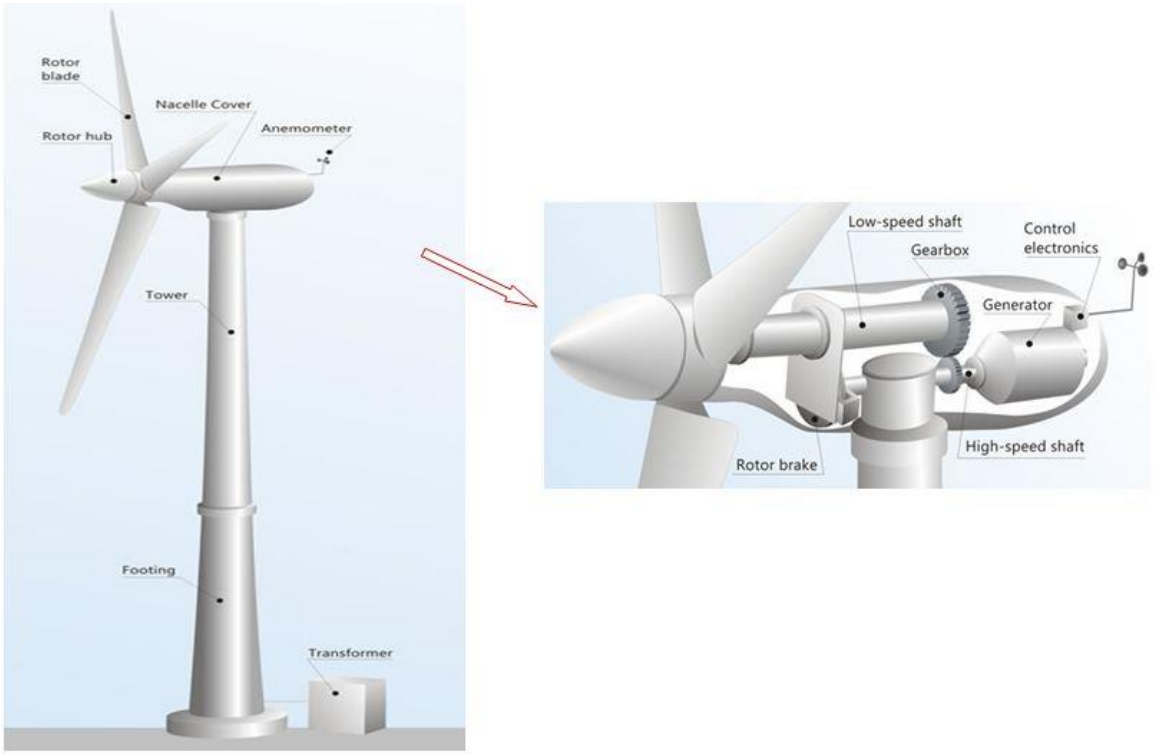


Plate 1: Typical Components of a Wind Turbine

The turbine rotor speed will vary according to the energy available in the wind, the wind speed. The turbines will generate power in wind speeds between approximately 3 metres per second (m/s) and 28 m/s (depending on the model of turbine) with maximum power output usually achieved at wind speeds of around 10 – 12 m/s. On average, wind speeds greater than approximately 28 m/s the turbines would will automatically turn the angle of the blade to reduce energy capture (this is known as 'pitching') and stop turning to prevent damage.

Each turbine will require a transformer and, depending on the selected model of turbine, this will be either located within the turbine tower or adjacent to the turbine on a concrete plinth.

The turbines will be placed on steel and concrete foundations which will each occupy an area of up to 25 m by 25 m in total (which includes the maximum total area that may need to be disturbed during construction of the foundation), and be typically up to 5 m deep and may include concrete and steel plinths depending upon local ground conditions.

Once construction is complete, much of the foundation area can be rehabilitated.

1.5.2 Hardstanding Areas

Each turbine requires an area of hard-standing to be built adjacent to the turbine foundation. This provides a flat, stable base on which to lay down the turbine components ready for assembly and erection and to site the two cranes necessary to lift the tower sections, nacelle and rotor into place.

A hardstanding area of up to 7500 m^2 will be established adjacent to each turbine location. This will be used to provide a platform for cranes to operate during construction (and unscheduled maintenance), as well as a clear area to lay out turbine components prior to erection.

The crane hard-standing will be left in place following construction in order to allow for use of similar plant should major components need replacing during the operational phase of the proposed development.

1.5.3 Laydown Areas

Additional temporary laydown areas will be required for equipment and component storage during construction across the site. These areas will be levelled and compacted and used for component storage. Temporary infrastructure would include a site camp, laydown areas and a batching plant.

1.5.4 Electrical Cabling and Onsite Substation

The electricity from the turbines will be transferred via a 33 kV electrical network to 2 x 80 MVA on-site switching station. Where possible this will be underground but the feasibility of this will be confirmed as the design progresses and geotechnical studies are conducted. The on-site switching station will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid. The operations and maintenance building including parking will be approximately 7500 m^2.

Underground cabling will link the turbines to each other and to the on-site transformer/ control building. Detailed construction and trenching specifications will depend on the ground conditions encountered. Typically cables would be laid in a trench approximately 1 m deep and 0.5 m wide. To minimise ground disturbance, cables will be routed along the side of the access tracks where practicable.

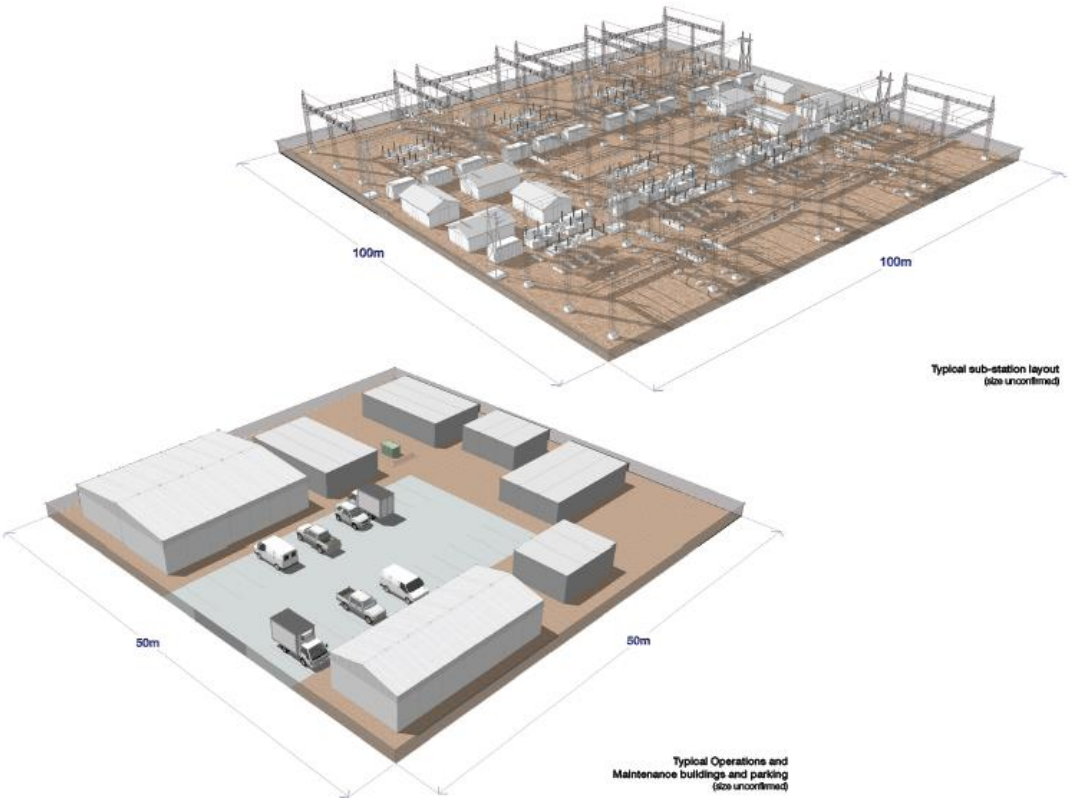


Plate 2: Typical Substation Layout

1.5.5 Access

The turbine locations will be accessed through a network of unsealed tracks which will be established across the WEF Site. These access roads will be between 8 m and 14 m wide.

A width of 14 m is required for curves in order to allow trucks to turn. Such roads are required to facilitate access for the cranes and abnormal load deliveries of turbine components.

Existing farm access roads will be upgraded and utilised where possible, as will existing watercourse crossings. Some of the aggregate required for the construction of the on-site tracks may be sourced from cut and fill operations during construction from within the proposed development site with additional material imported from permitted quarries as required. The need for this will be assessed during the EIA process.

If borrow pits are required, a separate application will be lodged with the Department of Mineral Resources in regard to this activity.

1.5.6 Compound

There will also be an on-site office compound, including site offices, parking and an operation and maintenance facility including a control room.

1.5.7 Ancillary Equipment

In addition to the key components outlined above, the WEF will also require:

- Meteorological masts;
- Security fencing; and
- CCTV monitoring equipment.

2 LEGAL FRAMEWORK

An application for Environmental Authorisation, in term of the National Environmental Management Act, Act 107, 1998 (NEMA), Environmental Impact Assessment Regulations, 2010, as amended, was submitted to the Department of Environmental Affairs. This section of the draft EMPr will need to be updated to include the recommendations and requirements that are outlined in the Environmental Authorisation, should this project be authorised by the DEA.

Table 2-1: The NEMA EIA Regulations Listed Activities Applicable to the Proposed WEF

Listing Notices 1 - 3 07 April 2017	***Listed Activity***	**Project Description**
Listing Notice 1 GN R 327 Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	The WEF will require transmission lines in order to connect to the grid. Electrical reticulation will be installed to transfer electricity from the turbines to an on-site substation. Cables will be installed underground where feasible.
Listing Notice 1 GN R 327 Activity 14	*The development and related operation of facilities or infrastructure, for the storgage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters.*	Estimated Volume of Hazardous Materials Stored on Site for 76 turbines over a construction period of 24 months. Construction Phase

Listing Notices 1 - 3 07 April 2017	*Listed Activity*	Project Description
		176.64m³; Operational Phase 197.62m³.
Listing Notice 1 GN R 327 Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	The construction of the WEF would likely include the excavation of soil in watercourses/drainage line areas, and infilling/deposition may exceed 5 cubic metres and in some instances may exceed 10 cubic metres. Figure 2 shows the location of water crossings. The construction of associated infrastructure, such as access tracks crossing watercourses may require excavation and/or infilling of watercourse areas.
Listing Notice 1 GN R 327 Activity 24	*The development of a road—* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*	Access roads will be required between turbines. These roads will be unsealed and will likely be between 8 - 14 m in width. The roads will be up to 14 m wide during construction, but will be reduced during operation.
Listing Notice 1 GN R 327 Activity 56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.*	Existing farm access roads may need to be widened or lengthened. These roads would currently have no road reserve and may be wider than 8 meters in some areas.
Listing Notice 2 GN R 325 Activity 1	*The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more*	The Phezukomoya WEF will consist of a number of wind turbines for electricity generation of more than 20 megawatts (up to 390 MW).
Listing Notice 2 GN R 325 Activity 6	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.*	The construction of the WEF requires a Water Use License in terms of the National Water Act,

Listing Notices 1 - 3 07 April 2017	*Listed Activity*	Project Description
		1998 (Act No. 36 of 1998).
Listing Notice 2 GN R325 Activity 9	*The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.*	The construction of a 132/400kV substation yard at the proposed Umsobomvu substation.
Listing Notice 2 GN R 325 Activity 15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity;* *(ii) maintenance* purposes undertaken in accordance with a maintenance management plan.	The construction of the WEF will require the clearance of approximately 150 hectares of vegetation in total across the site.
Listing Notice 3 GN R 324 Activity 4	*The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *g. Northern Cape* *Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Internal and external access roads will be constructed, which are wider than 4 m. The site falls outside of an urban area and parts of the site fall within a National Protected Area Expansion Strategy Focus area and CBA in the Northern Cape.
Listing Notice 3 GN R324 Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *g. Northern Cape* *iii. Within critical biodiversity areas identified in bioregional plans*	The proposed development will require the clearance of natural vegetation in excess of 300 m^2 in areas of natural vegetation. The area includes Critical Biodiversity Areas in the Northern Cape.
Listing Notice 3 GN R324 Activity 18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *ii. Outside urban areas* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas identified in systematic bioregional plans adopted by the competent authority or in bioregional plans*	Existing farm roads may need to be widened or lengthened. The site lies outside urban areas, and contains NPAES and CBAs in the Northern Cape.

Table 2-2: DEA requirements for EMPr from Acceptance of Scoping Report Letter

No.	Comments from DEA	Section in Report
i.	All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted.	Section 5 – 9
ii.	The final site layout map.	Figure 1

No.	Comments from DEA	Section in Report
iii.	Measures as dictated by the final site layout map and micro-siting.	Section 5 – 9, to be updated post micro-siting
iv.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Figure 2
v.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Figure 2
vi.	An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Section 10
vii.	A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed .This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Section 12
viii.	An avifauna monitoring and management plan to be implemented during the construction and operation of the facility. This plan must be drafted by a suitably qualified avifauna specialist.	Section 21
ix.	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Section 13
x.	An open space management plan to be implemented during the construction and operation of the facility.	Section 14
xi.	A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Section 15
xii.	A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment.	Section 16

No.	Comments from DEA	Section in Report
xiii.	A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Section 17
xiv.	A fire management plan to be implemented during the construction and operation of the facility.	Section 19
xv.	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Section 18
xvi.	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Section 23
xvii.	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Section 6 - 9

3 ENVIRONMENTAL IMPACT ASSESSMENT

The EMPr has been developed based on the findings and recommendations of the EIA (Arcus, 2018).

3.1 Summary of Findings

During the EIA process, impacts on both the biophysical and socio-economic environments were assessed. The following specialist's studies were commissioned based on the sensitivities of the site and the potential impacts of the proposed development:

- Geology, Soils and Agricultural Potential;
- Flora and Fauna (Terrestrial Ecology);
- Avifauna;
- Bats;
- Freshwater and Wetlands;
- Cultural Heritage, Archaeology and Palaeontology;
- Noise;
- Landscape and Visual;
- Traffic; and
- Socio-economy.

From the assessment, it is evident that the construction and the operation of the WEF and grid connections will have negative impacts both socially and environmentally but when appropriate mitigation measures applied negative impacts are outweighed by positive impacts. Overall the project has a positive economic impact regionally and for South Africa as a whole as power generated from the WEF will feed into the National Eskom grid, create job opportunities, and contribute to the local and regional economy.

3.2 Summary of the Impact Assessment

Potential environmental impacts were evaluated according to their extent, duration, intensity and magnitude. Negative impacts of the proposed project on the biophysical environment include clearing of vegetation that leads to habitat fragmentation, potential loss of species of concern, soil erosion, surface water pollution; while social-economic impacts being minimal loss of agricultural land, disruption of social relations within the proposed area by the introduction of contractor workers from different areas, spread of diseases, loss of potential heritage resources and impact on sense of place.

All impacts have been identified and assessed at different stages (design/planning, construction, operation and decommission) and possible mitigation measures assigned to ensure low significance (for negative impacts) or high significance (for positive impacts).

4 ENVIRONMENTAL MANAGEMENT PROGRAMME

This section forms the core of the EMPr and outlines the specific mitigation measures for those key impacts identified in the section above.

4.1 Environmental Awareness and Compliance

The philosophy that has been used for the compilation of this management programme is derived from the principles of the National Environmental Management Act (No. 107 of 1998) which states that development must be socially, economically and environmentally sustainable. Sustainable development requires that:

- The disturbance of ecosystems and loss of biodiversity are avoided (minimised or remedied);
- Pollution and degradation of the environment are avoided or minimised and remedied; Waste is avoided or minimised and re-used or re-cycled where possible and otherwise disposed of in a responsible manner;
- A risk averse and cautious approach is applied;
- Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.

The Act makes provision that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

4.2 Roles and Responsibilities for Good Environmental Management

The developer, together with each appointed contractor will be responsible for environmental management on site during the construction and operational phases of the proposed development. Specific roles and responsibilities are highlighted in the table below.

4.2.1 Developer Representative – Environmental Manager

- Review and approve EMPr prior to authorisation by DEA.
- Review and approve any EMPr updates or amendments.

- Ensure environmental requirements are integrated into the project plans, method statements and tender processes.
- Support the site environmental control officer during the construction phase, to ensure implementation of the EMPr.
- Follow up and close out all environmental incidents and non-conformances.
- Appointment a suitably qualified independent environmental control officer during the construction phase.

4.2.2 Principal Contractor Representative - Environmental Control Officer

An independent environmental consultant will arrange for inspections of the construction activities and EMPr implementation throughout the construction phase. After each inspection, the ECO will produce a monitoring report that will be submitted to the client, Department of Environmental Affairs (DEA) and Western Cape Environmental Department. Relevant sections of the minutes of customary (monthly) site meetings will be attached to the monitoring report.

The Environmental Control Officer (ECO) will be responsible for overseeing the implementation of the EMP during the construction and operations phases, and for monitoring, reviewing and verifying compliance of the contractor with the EMP, record-keeping and updating of the EMP as and when necessary.

The ECO will:

- Be fully knowledgeable with the contents of the EMP;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMP are communicated to the contractor, all site staff, and the contractor and /or site manager are made aware of the contents of the EMP, through presentations and discussions;
- Ensure that compliance to the EMP is monitored by regular and comprehensive inspection of the site and surrounding areas;
- Report on any incidents of non-compliance and ensure mitigation measure are implemented as soon as practical.

During *construction*, the Environmental Control Officer will be responsible for the following:

- Meeting on site with the Construction Manager prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Daily / weekly (depending on the extent of construction activities, at any given time) monitoring of site activities during construction to ensure adherence to the specifications contained in the EMP, using a monitoring checklist that is to be prepared by an independent environmental assessment practitioner at the start of the construction phase;
- Preparation of the monitoring report based on the site visit;
- Conducting an environmental inspection on completion of the construction period and signing off the construction process with the Construction Manager; and
- Maintain an Incidents Register and Complaints Register on site.

During *operation*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMP for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMP;
- Update the EMP and ensure that records are kept of all monitoring activities and results; and
- Maintain an Incidents Register and Complaints Register on site.

During *decommissioning*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMP for the decommissioning phase; and
- Conducting an environmental inspection on completion of decommissioning and "signing off" the site rehabilitation process.

4.3 Training and Induction of Employees

The contractor has a responsibility to ensure that all personnel involved in the project are aware of and are familiar with the environmental requirements for the project. The EMP shall be part of the terms of reference (ToR) for all contractors, sub-contractors and suppliers. All Contractors have to give some assurance that they understand the EMP and that they will undertake to comply with the conditions therein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMP. They shall know and understand the specifications of the EMP and be able to assist other staff members in matters relating to the EMP.

The Contractor must ensure that all staff working on site has an environmental induction. The presentation can include the following topics;

- What is meant by "Environment"?
- Why the environment needs to be protected and conserved.
- How construction activities can impact on the environment.
- What can be done to militate against such impacts?
- Awareness of emergency and spills response provisions.
- Social responsibility during construction e.g. being considerate to local residents.

A detailed environmental management and training program must be developed. The purpose of this is to ensure that all staff and workers understand what is required of them. The main components of the program can incorporate the following:

- Concept of sustainability and the reasons for good environmental management and practice
- Potential environmental impacts
- Mitigation measures
- Establishing a chain of responsibility and decision making
- Specific training requirements of certain staff, and the potential hazardous associated with the job.
- Methodologies to be used for field sampling
- Training in the use of field equipment
- Training in identification of non-compliance situations and procedures to be followed in such instances
- Reporting requirements
- Fire management
- HIV/AIDS

4.4 Complaints Register and Environmental Incidents Book

The Contractor must record any complaints received from the community. The complaint must be brought to the attention of the site manager and Environmental Control Officer, who will respond accordingly.

The following information will be recorded:

- Time, date and nature of the complaint;
- Response and investigation undertaken; and,
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) will be given to the complainant within 7 days.

All environmental incidents occurring on the site will be recorded. The following information will be provided:

- Time, date, location and nature of the incident,
- Actions taken and by whom.

4.5 Construction Environmental Monitoring

Environmental audits must be undertaken by an independent environmental consultant who will act as the Environmental Control Officer twice monthly, and on a daily basis or what is deemed necessary by the ECO during times of heavy earth works and vegetation clearing, in order to ensure compliance of all aspects of the EMP.

In order to facilitate communication between the ECO and the Resident Engineer and Contractor, it is vital that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the project team before being conveyed to the Contractor. In this way, penalties as a result of non-compliances with the EMP may be justified as failure to comply with instruction from the highest authority.

4.6 Dealing with Non Compliance with the EMP

There may be difficulties encountered with carrying out the mitigation measures within the EMPr, this may result in non-compliance with the EMP. It may be possible that the contractor and or the developer in place procedures to motivate staff members to comply with the EMPr and to deal with non-compliance. The developer must make this known to the contractor at the earliest stage possible, even during the tender phase.

4.7 EMP Amendments and Instructions

No EMP amendments shall be allowed without the approval of the DEA. Amendments may be possible, following discussions with the relevant ECO or environmental consultant, who may propose EMP amendments on behalf of the developer or issue EMP instructions, either corrective actions, remediation or rehabilitation. These correction action must be completed within the specified timeframes.

5 DESIGN PHASE / PRE–CONSTRUCTION PHASE MITIGATION MEASURES

The objectives of the pre-construction phase are:

- To promote environmental awareness.
- To define roles and responsibilities for environmental management;
- To ensure suitable environmental training and induction to all contractors, sub-contractors and labourers; and
- To ensure that all legal obligations and contractual conditions have been met prior to commencing of construction.

5.1 Mitigation measures for Legal Compliance

- Appoint an independent environmental control officer
- Appoint an internal environmental co-ordinator or environmental officer, to oversee day to day environmental activities.
- Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training.
- Before construction begins, all areas to be developed must be clearly demarcated with fencing, by a qualified surveyor.

- The contractor must ensure compliance with conditions described in the environmental authorisation.
- No construction camps are allowed on site. No workers are allowed to stay overnight in the construction area.
- Confirm with ECO, suitable sites for the construction camps (equipment and batching etc.) and storage areas for materials. All construction equipment must be stored within this construction camp and all associated oil changes etc. (no servicing) must take place within this camp.
- Unskilled labourers should be drawn from the local market where possible..
- Training of site staff.
- Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts.
- Project Manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.
- Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.
- No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager.

The developer must ensure that the following mitigation measures are applied to the proposed project prior to the construction phase. These measures must be included in an updated EMPr to be submitted to the DEA for approval.

Prior to the submission of the final layout plan to the DEA for approval, the following specialists must visit the site to assist with the micro-siting the layout and do a walkthrough of all power lines:

- Flora and fauna specialists
- Aquatic specialist
- Avifaunal specialist
- Palaeontologist

Following the selection of turbine to be used for the project, the developer must update the layout plan, this together with the following management plans, to be developed, must be submitted to the DEA for approval:

- Traffic Management Plan – this plan will include the necessary arrangements to transport all equipment and infrastructure to site, including the necessary road transport permits.
- Construction Site Traffic Management Plan – this will be in the form of a site layout, showing the flow of traffic during the construction phase taking into consideration existing land users.
- Storm water Management Plan – once the final layout plan has been produced the appointed responsible engineers must produce a storm water management plan for the site, during the construction and operational phases of the project.
- A health and safety plan must be drawn up to ensure worker safety.

Develop a Project Layout and Access Plan to show the intended use of the area. The plan shall clearly indicate and/or describe the location and details of:

- Servitudes.
- Areas and routes to be cleared – including the size / width of the cleared areas.
- The construction campsite and rest areas to be used during construction.
- Waste disposal sites to be used during construction.

- Sources of construction materials.
- Power supply during construction.
- Existing roads and tracks to be used as transportation routes, and routes to gain access to construction areas.
- New tracks deemed necessary to provide access to construction activities.
- Any informal residential structures found within the property.
- Affected land use, 1:50 year floodlines.
- Sensitive areas.

5.2 Method Statements

Prior to construction the developer must ensure that the contractor supply the following method statements:

- Vegetation clearing;
- Cement mixing;
- Hazardous waste management;
- Emergency preparedness and response;
- Hazardous spills clean up;
- Topsoil stockpiling management;
- Laydown area management;
- Hazardous materials management;

5.3 Site Establishment

The object of site establishment is to ensure that an appropriate site is selected for the construction camp/site office and that the site office is managed in an environmentally responsible manner with minimal impact on the environment.

5.3.1 Mitigation Measures

Before establishing the construction office areas, carefully plan the layout and develop a Construction Site Office Plan[1]. The Construction Site Office Plan shall provide a description of the site and shall show, on a reasonably scaled map, the intended use of the site. Indicate and/or describe the location, size / quantity / capacity and design of:

- Access routes;
- Ablution facilities (including details on the handling of sewage and wastewater);
- On-site waste management facilities (waste containers, etc.);
- Design of bunds and other structures for containment of hazardous substances;
- Fencing;
- Water storage and supply;
- Power supply (for cooking, space heating, lighting, etc.);
- Fire extinguishers, first aid kit and any other relevant safety equipment;
- Other structures and buildings (offices, storerooms, workshops, etc.);
- Other storage areas and stockpiles (i.e. topsoil, construction materials, equipment, etc.);

Location of areas to be reinstated upon completion of the construction period, providing measures to be used for reinstatement.

- An area within the site must be demarcated for a construction site office, which will include storage area. This area must be fenced off.
- Site establishment shall take place in an orderly manner and all required amenities shall be installed at the lay down area before the main workforce move onto site.

[1] To form part of the Project Layout and Access Plan.

- The construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction.
- The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities.
- The Contractor shall supply waste collection bins and all solid waste collected shall be disposed of at a registered landfill.
- Potable water for use by on site workers must be made available on a daily basis at the site office and the working areas on site.
- A certificate of disposal shall be obtained by the Contractor and kept on file. Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.
- The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.

5.3.2 Siting, Establishing and Management of Storage Material and Facilities

- Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.
- Storage areas must be designated, demarcated and fenced.
- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children / animals etc.
- Fire prevention facilities must be present at all storage facilities.
- Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s).
- These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be sited away from drainage lines in a site with the approval of the Engineer.
- Any water that collects in the bund must not be allowed to stand and must be removed immediately and the hydrocarbon digestion agent within must be replenished.
- All legal compliance requirements with respect to Fuel storage and dispensing must be met.
- All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements.
- Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations
- Flammable fuel and gas must be well separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire.
- The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials.
- Symbolic safety signs depicting "No Smoking", "No Naked Flames" and "Danger" are to be prominently displayed in and around the fuel storage area.
- The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified.
- There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas.
- The storage tank must be removed on completion of the construction phase of the project.

- All such tanks to be designed and constructed in accordance with a recognised code (international standard).
- The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage.
- Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected.
- Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product.
- If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used.
- The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use.
- All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site.
- The amounts of fuel and chemicals stored on site must be minimised.
- Storage sites must be provided with bunds to contain any spilled liquids and materials.
- These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.
- Clear signage must be placed at all storage areas containing hazardous substances / materials.
- Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available, MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes.
- Storage areas containing hazardous substances / materials must be clearly signed.
- Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.
- A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes should only be disposed of at licensed landfill sites designed to handle hazardous wastes.
- The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.
- All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site.
- Any spillage, which may occur, shall be investigated and immediate action must be taken.

6 CONSTRUCTION PHASE MITIGATION MEASURES

The following sections form the core of the EMPr during the construction phase of the proposed development. The developer is to ensure that the contractor complies with all mitigation measures during the construction period. The major sources of potential impacts include, the turbine footprint construction, the construction of buildings and infrastructure, the construction of roads and bridges, and vehicle operation, and spillages.

The following is not allowed on site:

- No poaching of any animals or harvesting of any flora;

- No construction camp, for workforce accommodation is allowed on site; contractors are to ensure suitable housing for staff outside of the proposed development footprint.
- No cooking or fires allowed on site;
- No alcohol or drugs are allowed on site;

6.1 Potential Construction Phase Impacts

The following impacts are likely to occur during the construction of the proposed WEF. Specific mitigation measures for each impact is presented in the table below.

- The accidental, negligent, or deliberate spillage or inappropriate disposal of hazardous substances could result in air, soil and water pollution and may affect the health and well-being of people, plants and animals.
- Excessive noise could be made by the construction activity which would affect neighbouring communities.
- Potential damage to the soil structure, soil compaction and loss of soil fertility.
- Loss of the vegetation cover and increased erosion risks.
- Dust related problems.
- Safety hazards to the public, workers and animals in the area.
- Disturbance to local hydrology from construction activities.
- Pollution of surface water bodies
- Dust can be a nuisance to the construction workforce and to the public and can negatively affect the growth and recovery rate of plants. Potential sources of fugitive dust include, but are not limited to:
  - Demolition of concrete foundations and existing buildings;
  - Grading / movement of soil;
  - Transportation and unloading of construction materials;
  - Vehicular movement over unsurfaced roads and tracks; and,
  - Wind erosion of stockpiles.
- Construction activities will result in the exposure of the soil to erosive factors, i.e. wind and water, and the compaction of the soil in other areas;
- Illegal poaching and collection of animals and plant material.
- Loss of established indigenous and exotic habitat
- Unnecessary trampling of vegetation and harm to animals.
- Degradation of the scenic quality due to the major earthworks and any unsightly structures.
- Damage or loss of important cultural, historical or pre-historical sites and artefacts.
- Damage to existing roads and tracks, power lines, pipelines, etc.
- Dangerous conditions near road.
- Trespassing and illegal access onto land.

The table below presents a summary of the potential impacts as assessed by specialists for the construction phase of the WEF.

Table 6-1: Summary of Construction Phase Impacts

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of agricultural land	Low	Low	Low	Negative	**Low**	High	High
With Mitigation	Low	Low	Low	Neutral	**Low**	High	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	High	High

With Mitigation	Low	Low	Low	Neutral	**Low**	High	High
Freshwater and Wetlands							
Loss of riparian systems and water courses during the construction phase of the WEF	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Impact on localized surface water quality mainly during the construction phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							
Impact on vegetation and listed plant species due to transformation within the development footprint	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	High	High
Faunal impacts due to construction-phase noise and physical disturbance	Low	Medium	High	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	High	Medium
Avifauna							
Displacement of priority species due to construction activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Displacement of priority species due to construction activities associated with the grid connection powerline.	Low	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	Medium
Bats							
Destruction of bat roosts due to	Medium	Low	High	Negative	**Medium**	Medium	High

earthworks and blasting							
With Mitigation	Low	Low	Medium	Negative	**Low**	Low	High
Loss of foraging habitat	Low	High	Low	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Noise							
Daytime construction of the Access Roads	Low	Low	High	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of the Access Roads	Low	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from day time construction traffic	Low	Low	High	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from night-time construction traffic	Low	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Daytime construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Visual							
Impact on access roads	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Impact on cabling	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Heritage							
Impacts to Archaeological Heritage	Low	High	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	High	Low	Negative – Neutral	**Low**	Low	High
Impacts to Colonial Period Heritage	Low	Low	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative – Neutral	**Low**	Low	High
Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High
Palaeontological Heritage Impact							

Impacts to Palaeontology	Low	High	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	High	Low	Neutral – Pos.	**Low**	Low	High
Social							
Creation of local employment, training and business opportunities	Medium	Low	Medium	Positive	**Medium**	Medium	High
With Mitigation	High	Low	High	Positive	**High**	High	High
Impact of construction workers on local communities	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Influx of job seekers	Medium	Low	Low	Negative	**Low**	Medium	Medium
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	Medium
Risk to safety, livestock, farm infrastructure and farming operations	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Increased fire risk	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Impacts associated with construction vehicles	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Impact associated with loss of farmland	Medium	Low	Low	Negative	**Low**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High

Table 6-2 Construction Phase Mitigation Measures

Mitigation Measure	Responsibility	Frequency
Geology, Soils and Agricultural Potential Impact		
Loss of agricultural land • Avoid any areas under cultivation (if any).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Increased soil erosion hazard • Minimize vegetation removal to smallest possible footprint. • Control possible runoff by using soil conservation and soil retention measures, especially on steep slopes. • Store any removed topsoil for later use (contains indigenous seeds etc.) and re-vegetate as soon as possible. • Once specific infrastructure sites are known, site-specific measures can be devised for implementation and any potentially high risk sites can be identified.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Freshwater and Wetlands		
Loss of riparian systems and water courses during the construction phase of the WEF • Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint). • If several the transmission line towers for the grid need to be located within some of the watercourses, then this must be carried out in collaboration with an aquatic specialist during the micro siting process • No vehicles to refuel or be maintained within drainage lines/ riparian vegetation. • During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required. • Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase • Any storm water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Impact on localized surface water quality mainly during the construction phase • Strict use and management of all hazardous materials used on site. • Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.). • Containment of all contaminated water by means of careful run-off management on the development site. • Strict control over the behaviour of construction workers. • Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. • Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Flora and Terrestrial Fauna		
Impact on vegetation and listed plant species due to transformation within the development footprint • Placement of turbines within the High Sensitivity areas and drainage lines should be avoided. • Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are avoided where possible. • Ensure that lay-down and other temporary infrastructure is within medium- or low- sensitivity areas. The assessed locations are considered acceptable, but should be rehabilitated after use.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. • The exact routing of the roads should be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-though of the facility. • Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. • Demarcate sensitive areas in close proximity to the development footprint as no-go areas with construction tape or similar and clearly mark as no-go area.		
Faunal impacts due to construction-phase noise and physical disturbance • Preconstruction walk-through of the facility to identify areas of faunal sensitivity. • During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. • The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site. • Fires within suitable dedicated containers (i.e. braai drums etc.) should only be allowed within the construction camp and similar demarcated and cleared areas and no fires should be allowed in the open veld as there is a risk of runaway veld fires. • No fuelwood collection should be allowed on-site. • No dogs or cats should be allowed on site apart from that of the landowners. • If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • No unauthorized persons should be allowed onto the site and site access should be strictly controlled • All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site. • All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often needlessly persecuted.		
Avifauna		
Displacement of priority species due to construction activities at the wind development area • Restrict the construction activities to the construction footprint area. • Do not allow any access to the remainder of the property during the construction period. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • It is recommended that a 2.5km pre-cautionary no-go buffer is implemented around the Verreaux's Eagle nest at FP1 (31°12'59.66"S 24°57'26.08"). • The appointed Environmental Control Officer (ECO) should be trained by an avifaunal specialist to identify the signs that indicate possible breeding by priority species. The ECO must	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
then, during audits/site visits, make a concerted effort to look out for such breeding activities of such species, and such efforts may include the training of construction staff to identify such species, followed by regular questioning of staff as to the regular whereabouts on site of the species. If any priority species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and the avifaunal specialist will be contacted immediately for further assessment of the situation and instruction on how to proceed.		
Displacement of priority species due to construction activities associated with the grid connection powerline. • Restrict the construction activities to the construction footprint area. • Do not allow any access to the remainder of the property during the construction period. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • The final powerline route should be assessed by the avifaunal specialist way of a walk-down to identify any priority species nests which could be impacted by the construction activities. Should a nest be discovered, the avifaunal specialist must have input into the construction schedule to assess how and which of the construction activities can be timed to minimize the disturbance potential to the occupants of the nest.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Bats		
Destruction of bat roosts due to earthworks and blasting • Adhere to the sensitivity map during turbine placement. • Blasting should be minimised and used only when necessary.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Loss of foraging habitat • Adhere to the sensitivity map.	Site engineer/ site manager Developer to implement	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. • Damaged areas not required after construction should be rehabilitated by an experienced vegetation succession specialist.	ECO and Safety Officer	
Noise		
Night-time construction of the Access Roads • Where possible, do not allow night-time construction activities located within 800m from potential noise-sensitive receptors.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Noise from day time construction traffic • Where possible relocate access roads to be further than 60m from dwellings occupied by people (during construction period) to reduce the significance of noise from construction traffic during the day.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Noise from night-time construction traffic • Where possible relocate access roads to be further than 140 m from dwellings occupied by people (noise level below 42 dBA). • Minimize or eliminate night-time traffic that may pass within 140 m (ideally) from noise-sensitive receptors for a noise impact of low significance.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Visual		
Impact on access roads • Carefully plan to reduce the construction period. • Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. • Maintain a neat construction site by removing rubble and waste materials regularly. • Make use of existing gravel access roads where possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Ensure that dust suppression techniques are implemented on all access roads, especially those leading up steep slopes.		
Impact on cabling • All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid. • Carefully plan to reduce the construction period. • Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. • Maintain a neat construction site by removing rubble and waste materials regularly. • Make use of existing gravel access roads where possible. • Ensure that dust suppression techniques are implemented on all access roads.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Heritage		
Impacts to Archaeological Heritage • Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. • Report any chance discoveries of human remains to an archaeologist or a heritage authority. • Moderate mitigation requirements have been identified that involve the avoidance of, or professional collection of archaeological material from archaeological sites JG001-3, JR001 and JG026.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Impacts to Colonial Period Heritage • Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. • Do not demolish without authority authorisation, ideally reuse old structures and cottages, care for the fabric but change it as little as possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Impacts to cultural landscape and setting	Site engineer/ site manager	Throughout operation.

Mitigation Measure	Responsibility	Frequency
• Mitigation can be achieved only in part due to size of turbines. • Adhere to findings and recommendations of the Visual Impact Assessment.	Developer to implement ECO and Safety Officer	Monthly checks
Paleontological Heritage Impact		
Impacts to Palaeontology • Safeguarding of chance fossil finds (preferably in situ) during the construction phase by the responsible ECO, followed by reporting of finds to Heritage Western Cape / SAHRA. • The monitoring of 10% of excavations into bedrock as per SAHRA guideline. • The avoidance of any buffer zones as recommended by the palaeontologist. • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy) within the final footprint. • Curation of fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Social Impacts		
Creation of local employment, training and business opportunities **Employment** • Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area; • Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Before the construction phase commences the proponent should meet with representatives from the ULM and IYLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase; • The local authorities, relevant community representatives and local farmers should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project; • Where feasible a training and skills development programmes for local workers should be initiated prior to the initiation of the construction phase; • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. **Business** • The proponent should liaise with the ULM and IYLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work; • Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information. • The ULM and IYLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.		

Mitigation Measure	Responsibility	Frequency
• Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase		
Impact of construction workers on local communities • Where possible the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories; • The proponent should consider the need for establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the ULM and IYLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers; • The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation; • The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; • The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site; • Where necessary, the contractors should make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks; • It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.		
Influx of job seekers • The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities; • The proponent should implement a policy that no employment will be available at the gate and or in the local towns in the area (except for local residents).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Risk to safety, livestock, farm infrastructure and farming operations • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences; • Contractors appointed by the proponent should provide daily transport for workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties; • The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; • The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below); • The Environmental Management Programme (EMP) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; • The housing of construction workers on the site should be limited to security personnel.		
Increased fire risk • The proponent should enter into an agreement with the local farmers in the area whereby losses associated with fires that can be proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences; • Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas; • No smoking should be permitted on site, except in designated areas; • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months; • Contractor to provide adequate firefighting equipment on-site; • Contractor to provide fire-fighting training to selected construction staff; • No construction staff, with the exception of security staff, to be accommodated on site over night; • As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the firefighting costs borne by farmers and local authorities.		
Impacts associated with construction vehicles • As far as possible, the transport of components to the site along the N10 and N9 should be planned to avoid weekends and holiday periods; • The contractor should inform local farmers and representatives from the ULM and IYLM Tourism of dates and times when abnormal loads will be undertaken; • The contractor must ensure that damage caused by construction related traffic to internal farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor; • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis, adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; • All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits;	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• The Contractor should ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows should be fined; • The Contractor should be required to collect waste along the road reserve on a weekly basis; • Waste generated during the construction phase should be transported to the local landfill site. • EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times; • EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.		
Impact associated with loss of farmland • The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of the soil and vegetation study. In this regard areas of high potential agricultural and sensitive vegetation soils should be avoided; • The developer should consult with affected property owners in order to enable them to factor construction activities into their farming schedules; • The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowner in the finalisation process and inputs provided should be implemented in the layout as best as possible; • The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible; • An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase; • All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
informed by input from the soil scientist and discussed with the local farmer; • The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA; • The implementation of the Rehabilitation Programme should be monitored by the ECO; • All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas; • EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld; • Disturbance footprints should be reduced to the minimum. • Compensation should be paid by the developer to farmers that suffer a permanent loss of land due to the establishment of the WEF. Compensation should be based on accepted land values for the area.		

6.2 Post Construction

- Once construction has been completed on site and all excess material has been removed, the storage area shall be rehabilitated. If the area was badly damaged, re-seeding shall be done and fencing in of the area shall be considered if livestock/faunal species specific to the area may subsequently have access to such an area.
- Such areas shall be rehabilitated to their natural state. Any spilled concrete shall be removed and soil compacted during construction shall be ripped, levelled and re-vegetated.
- Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment.
- Specific areas must be designated for cement/concrete mixing/ batching plants. Sufficient drainage for these plants must be in place to ensure that soils do not become contaminated.
- The construction camp must be kept clear of litter at all times.
- Spillages within the construction camp need to be cleaned up immediately and disposed of in the hazardous skip bin for correct disposal.
- All remaining material including building rubble and waste are to be removed from the site.
- All areas disturbed should be managed to ensure efficient drainage.
- The area designated for the deposition of spoil material is to be levelled and shaped to ensure the efficient drainage of the site. Under no circumstances is general or hazardous waste to be disposed of at this site.

6.2.1 Infrastructure

- Disassemble all temporary infrastructure units and remove components from the working areas and contractors camp. This will include storage structures and containers, water storage container, power supply, workers accommodation, sewage systems.
- Drain all potable chemical toilets, being careful not to spill the contents. Transfer the waste to an appropriate disposal site.
- Drain all waste water and sewage associated with temporary ablution facilities and transfer the waste to an appropriate disposal site to be identified by the contractor.
- Disassemble all fencing around the camp and either sell, suction or donate to the local community or transfer the waste components to a disposal site or the contractor's base.
- Do not leave any components, waste or infrastructure units within the working area and camp unless specifically required for the operation and maintenance phases and as agreed by the ECO.

6.2.2 Contaminated Substrate and Pollution Control Structures

- Excavate all areas of contaminated substrate, transfer the contaminated substrate to an appropriate disposal site and treat the affected areas.
- Remove all plastic linings used for pollution control and transfer to an appropriate disposal site.
- Break up all concrete structures that have been created and remove concrete waste to an appropriate disposal site.

6.2.3 Waste

- Remove all remaining construction materials from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor's base.

- Remove all construction debris, litter and domestic waste from the camp and working areas and transfer to an appropriate disposal site. Remove all waste receptacles from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor's base.

7 OPERATIONAL PHASE MITIGATION MEASURES

Once the construction and commissioning of the WEF is completed the project becomes operational. The operator of the WEF has the responsibility to ensure that the mitigation measures proposed for the operational phase of the WEF is implemented and conducted appropriately. The main impacts associated with the operation phase of the WEF relate to birds and bats.

During operation of the development, the large majority of the WEF sites will continue with agricultural use as it is currently. The only development related activities on-site will be routine servicing and unscheduled maintenance. The noise impact from maintenance activities is insignificant, with the main noise source being the wind turbine blades and the nacelle (components inside).

Although noise and disturbance levels during operation will be significantly reduced compared to construction, some noise and disturbance impacts will persist due to operational activities on the wind farm as well as noise generated by the turbines themselves. Due to the low significance of a noise impact, no routine noise measurement programme is recommended. Measurement locations, frequencies and procedures are provided as a guideline for the developer to consider should there be a noise complaint.

As the affected areas are not considered to be very high faunal sensitivity and there are no species of very high sensitivity present, the post-mitigation operational impacts on fauna are likely to be of low significance.

Displacement of priority species due to habitat destruction during operational lifetime of the wind energy facility phase is likely to be a medium negative impact but will be reduced to a low level with the application of mitigation measures. Species most likely to be affected by the habitat destruction (particularly fragmentation) are the terrestrial species such as Blue Crane, Ludwig's Bustard, Secretarybird and Grey-winged Francolin. The rehabilitation of disturbed areas will help to mitigate the impact of the habitat transformation to some extent, but the fragmentation of the habitat due to the construction of the internal road network cannot be mitigated, and will remain an impact for the duration of the operational life-time of the facility.

Collisions of priority species with the turbines in the operational phase are likely to be a medium negative impact and it could be reduced to a low negative level through the application of mitigation measures. Species most likely to be at risk of collision with the turbines are Lesser Kestrel and Jackal Buzzard. The impact is likely to persist for the operational life-time of the project. Implementation of the proposed mitigation measures should reduce the probability and severity of the impact on priority species to such an extent that the overall significance should be reduced to low.

Mortality of priority species with the grid connection and internal medium voltage network due to collisions in the operational phase is likely to be of medium significance, and will remain as such after the implementation of mitigation measures.

During the operational life of the wind farm, it is expected that physical impacts to heritage will diminish or cease. Impacts to intangible heritage are expected to occur. Such impacts relate to changes to the feel, atmosphere and identity of a place or landscape. Such changes are evoked by visual intrusion, noise, changes in land use and population density. In the case of this project there are no inhabited structures with or close to the project area therefore these impacts will not apply.

It is recommended that curtailment be applied from the start of operation at Level 3 on all turbines for every night of the year from dusk until dawn. Should robust and scientifically defendable data gathered during the operational study phase reveal higher bat mortalities than currently anticipated, the mitigations should be applied to the turbines identified as causing the highest impacts.

The developer has the responsibility to ensure that all operational mitigation measures outlined in this document, and all revisions thereof, are complied with.

7.1 Potential Operation Phase Impacts

The table below provides a summary of the potential impacts of the operation of the WEF, as assessed by specialists.

Table 7-1: Summary of Operational Phase Impacts

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of agricultural land	Low	Low	Low	Negative	**Low**	High	High
With Mitigation	Low	Low	Low	Neutral	**Low**	High	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Neutral	**Low**	High	High
Freshwater and Wetlands							
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function.	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							
Faunal impacts due to operational activities	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Medium	High
Soil Erosion Risk	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Alien Plant Invasion	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Medium	High
Impact on Critical Biodiversity Areas and	Medium	High	Medium	Negative	**High**	High	High

Broad-Scale Ecological Processes							
With Mitigation	Low	High	Medium	Negative	**Medium**	Medium	High
Avifauna							
Direct mortality of priority species due to electrocution associated with the internal medium voltage MV powerline at the wind development area	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Medium	Negative	**Low**	Low	High
Displacement of priority species due to habitat destruction at the wind development site	Low	High	Low	Negative	**Medium**	Medium	Medium
With Mitigation	Low	High	Low	Negative	**Low**	Low	Medium
Direct mortality of priority species due to collisions with the turbines at the wind development area	Low	Medium	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	Low
Bats							
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	High	Low	Negative	**Medium**	Medium	High
Artificial Lighting	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	High	Low	Negative	**Low**	Low	High
Noise							
Daytime operation of Wind Turbines	Low	Medium	Low	Negative	**Low**	Low	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Night-time operation of Wind Turbines	Medium	Medium	Medium	Negative	**Low**	Low	High
With Mitigation	Medium	Medium	Medium	Negative	**Low**	Low	High
Visual							
Impact on access roads	Medium	Medium	High	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Impact on cabling	Medium	Medium	High	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Heritage							

Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High
Social							
Development of renewable energy infrastructure	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Creation of employment and business opportunities and support for local economic development	Medium	Medium	Low	Positive	**Low**	Medium	High
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Benefits associated with the establishment of a Community Trust	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Generate income for affected landowners	Medium	Medium	Low	Positive	**Low**	Medium	High
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Impact on sense of place and rural character of the landscape based on findings of VIA	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium – High
With Mitigation	Medium	Medium	Medium – Low	Negative	**Medium – Low**	Medium	Medium – High
Potential impact on property values	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	Medium
Potential impact on tourism	Medium	Medium	Low	Negative	**Low**	Medium	High
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	High

Table 7-2 Operational Phase Mitigation Measures

Mitigation Measure	Responsibility	Frequency
Geology, Soils and Agricultural Potential Impact		
Loss of agricultural land • Avoid any areas under cultivation (if any).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Increased soil erosion hazard • Minimize vegetation removal to smallest possible footprint. • Control possible runoff by using soil conservation and soil retention measures, especially on steep slopes. • Store any removed topsoil for later use (contains indigenous seeds etc.) and re-vegetate as soon as possible. • Once specific infrastructure sites are known, site-specific measures can be devised for implementation and any potentially high risk sites can be identified.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Freshwater and Wetlands		
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function • Any storm water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. This is particularly important due to the levels of erosion already observed within the affected catchments.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase • Any storm water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
Flora and Terrestrial Fauna		
Faunal impacts due to operational activities • Management of the site should take place within the context of an Open Space Management Plan. • No unauthorized persons should be allowed onto the site. • Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except landowners or other individuals with the appropriate permits and permissions where required. • If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs) as far as possible, which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
placed on the inside of such fenced areas and not the outside.		
Soil Erosion Risk • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Alien Plant Invasion • Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as Prosopis are already present in the area and are likely to increase rapidly if not controlled. • Regular monitoring for alien plants within the development footprint as well as adjacent areas	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
which receive runoff from the facility as there are also likely to be prone to invasion problems. • Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.		
Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes • Minimise the development footprint, especially within the high sensitivity areas and some reduction in the number of turbines within these areas may be required. • There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. • Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Avifauna		
Direct mortality of priority species due to electrocution associated with the internal medium voltage MV powerline at the wind development area • The final powerline design and associated electrocution mitigation measures (if necessary) must be approved and signed off by the avifaunal specialist.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Displacement of priority species due to habitat destruction at the wind development site • The recommendations of the specialist ecological study must be strictly adhered to. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist.		
Direct mortality of priority species due to collisions with the turbines at the wind development area • Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates. • The avifaunal specialist, in consultation with external experts and relevant NGO's such as BLSA, should determine annual mortality thresholds for priority species anticipated to be at risk of collision mortality, prior to the wind farm going operational. • If actual collision rates exceed the pre-determined threshold levels, curtailment of turbines should be implemented for high risk situations. • A 150m no-turbine set-back buffer zone (infrastructure is allowed) is required around the escarpment to minimise the risk of collisions for slope soaring species. • It is recommended that a 2.5km pre-cautionary no-go buffer is implemented around the Verreaux's Eagle nest at FP1 (31°12'59.66"S 24°57'26.08"). • In addition, it is recommended that turbines 7, 62 and 63 are relocated to the top of the plateau as they pose a high collision risk on the slopes where they are situated. • Care should be taken not to create habitat for prey species that could draw priority raptors into the area and expose them to collision risk. Rock piles must be removed from site or covered with topsoil to prevent them from becoming habitat for Rock Hyrax (Dassie).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Bats		

Mitigation Measure	Responsibility	Frequency
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration) • Adhere to the sensitivity maps. • Avoid areas of high bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers. • Adhere to operational mitigation measures that may be deemed necessary during the operational monitoring assessment, if any is required.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Artificial lighting • If Possible, utilise lights with wavelengths that attract less insects (low thermal/infrared signature). • Lights should be switched off when not in use or equipped with passive motion sensors.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Visual		
Impact on access roads • Medium-high visual impact zones should be viewed as zones where the number of turbines should be limited, where possible. • No turbines should be placed within 500m of the N9, N10 and R389 provincial road. • Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity. • Turbines should be painted plain white, as this is a less industrial colour (Vissering, 2011). Bright colours or obvious logos should not be permitted. • Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011). • If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
impact that would typically be experienced in a chaotic landscapes made up of diverse colours, textures and patterns (Vissering, 2011). • Light fittings for security at night should reflect the light toward the ground and prevent light spill. • Ensure that dust suppression techniques are implemented on all access roads.		
Impact on cabling • Light fittings for security at the on-site switching station at night should reflect the light toward the ground and prevent light spill. • Where practically possible, the operations and maintenance buildings should not be illuminated at night. • Power lines should be aligned to run parallel to existing power lines and other linear infrastructure, if possible. • Power lines should be aligned to avoid ridgelines and steep slopes, if possible. • Cables should be buried underground where possible. • The operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. • Ensure that dust suppression techniques are implemented on all access roads. • Select the alternatives that will have the least impact on visual receptors.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Heritage		
Impacts to cultural landscape and setting • Mitigation can be achieved only in part due to size of turbines. • Adhere to findings and recommendations of the Visual Impact Assessment.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
Social		
Development of renewable energy infrastructure • Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members; • Maximise opportunities for local content, procurement and community shareholding; • Establish a visitor centre.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Creation of employment and business opportunities and support for local economic development • Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members; • Maximise opportunities for local content, procurement and community shareholding; • Establish a visitor centre. • The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project; • The proponent, in consultation with the ULM and IYLM, should investigate the options for the establishment of a Community Development Trust.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Benefits associated with the establishment of a Community Trust • The ULM and IYLM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the ULM and IYLM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager;	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; • Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF.		
Generate income for affected landowners • Implement agreements with affected landowners.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Impact on sense of place and rural character of the landscape based on findings of VIA • The recommendations contained in the VIA should be implemented, specifically the measures aimed at addressing the impact of aviation lights at night.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Potential impact on property values • The recommendations contained in the VIA should be implemented.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Potential impact on tourism • The recommendations contained in the VIA should be implemented; • The proponent should consider the establishment of a visitor centre should the proposed WEF be approved.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

8 DECOMMISSIONING PHASE MITIGATION MEASURES

8.1 Potential Decommissioning Phase Impacts

The table below provides a summary of the potential impacts of the decommissioning of the WEF, as assessed by specialists.

Table 8-1: Summary of Decommissioning Phase Impacts

Decommissioning Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Flora and Terrestrial Fauna							
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Medium	Negative	**Low**	Medium	High
Following decommissioning, the site will be highly vulnerable to soil erosion	Medium	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Medium	Negative	**Low**	Medium	High
Alien Plant Invasion following decommissioning	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Avifauna							
Displacement of priority species due to dismantling activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Displacement of priority species due to dismantling of the powerline	Low	Low	Low	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	Medium
Social							
Loss of jobs and associated income	Medium	Medium	Medium	Negative	**Medium**	Medium	High
With mitigation	Medium	Low	Low	Negative	**Low**	Medium	High

Table 8:8-2 Decommissioning Phase Mitigation Measures

Mitigation Measure	Responsibility	Frequency
Flora and Terrestrial Fauna		
Faunal impacts due to decommissioning phase activities • Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped. • All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and recycling plan, and as per the agreements with the land owners concerned.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Following decommissioning, the site will be highly vulnerable to soil erosion • Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.		
Alien Plant Invasion following decommissioning • Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after decommissioning activities are complete to encourage natural regeneration of the local indigenous species. • Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. • Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasive species are no longer a problem at the site. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Avifauna		
Displacement of priority species due to dismantling activities at the wind development area • Restrict the dismantling activities to the footprint area. • Do not allow any access to the remainder of the property during the dismantling period.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
• Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.		
Displacement of priority species due to dismantling of the powerline • Restrict the dismantling activities to the footprint area. • Do not allow any access to the remainder of the property during the dismantling period. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • An avifaunal specialist should perform a walk-through of the powerline prior to the commencement of the dismantling activities to identify any raptor nests on the line. Should a nest be discovered, the avifaunal specialist must have input into the dismantling schedule to assess how and which of the dismantling activities can be timed to minimize the disturbance potential to the occupants of the nest.	Site engineer/ site manager Developer to implement ECO	Throughout operation. Monthly checks
Social		
Loss of jobs and associated income • The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned. • All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; • The proponent should investigate the option of establishing an Environmental Rehabilitation	Site engineer/ site manager Developer to implement ECO	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Frequency
Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site.		

9 CUMULATIVE IMPACT MITIGIATION MEASURES

9.1 Geology

The likelihood of cumulative impacts is small. Only if other developments (whether wind farms or not) were to occur, using the same access roads and thereby increasing potential soil erosion aspects, would cumulative impacts need to be considered.

9.2 Freshwater and Wetlands

Overall cumulative impact during the construction and operational phases mitigation measures is to improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region and install properly sized culverts with erosion protection measures at the present road / track crossings.

9.3 Flora and Terrestrial Fauna

Contribution of the Phezukomoya WEF to cumulative impacts on habitat loss and future ability to meet conservation targets mitigation measures is to reduce residual risk or enhance opportunities by minimising the development footprint, especially within the high sensitivity areas as far as possible and have an integrated management plan for the development area during operation, which is beneficial to fauna and flora.

9.4 Avifauna

Cumulative impacts on avifauna are displacement of priority species due to construction activities at the wind development area; mortality of priority species due to electrocution associated with the internal medium voltage MV powerlines; direct mortality of priority species due to collisions with the turbines at the wind development area; displacement of priority species due to dismantling activities at the wind development area; and direct mortality of priority species due to collisions with the internal medium voltage MV lines and the 132kV grid connection powerline.

9.4.1 Mitigation Measures

All proposed mitigation measures for Construction, Operational and Decommissioning Impact Phases of the Phezukomoya WEF should be implemented:

- Restrict the construction activities to the construction footprint area.
- Do not allow any access to the remainder of the property during the construction period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- It is recommended that a 2.5km pre-cautionary no-go buffer is implemented around the Verreaux's Eagle nest at FP1 (31°12'59.66"S 24°57'26.08").
- The appointed Environmental Control Officer (ECO) should be trained by an avifaunal specialist to identify the signs that indicate possible breeding by priority species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of such species, and such efforts may include the training of construction staff to identify such species, followed by regular questioning of staff as to the regular whereabouts on site of the species. If any priority species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and the avifaunal specialist will be contacted immediately for further assessment of the situation and instruction on how to proceed.

- The final powerline route should be assessed by the avifaunal specialist way of a walk-down to identify any priority species nests which could be impacted by the construction activities. Should a nest be discovered, the avifaunal specialist must have input into the construction schedule to assess how and which of the construction activities can be timed to minimize the disturbance potential to the occupants of the nest.
- The final powerline design and associated electrocution mitigation measures (if necessary) must be approved and signed off by the avifaunal specialist.
- The recommendations of the specialist ecological study must be strictly adhered to.
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist.
- Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates.
- The avifaunal specialist, in consultation with external experts and relevant NGO's such as BLSA, should determine annual mortality thresholds for priority species anticipated to be at risk of collision mortality, prior to the wind farm going operational.
- If actual collision rates exceed the pre-determined threshold levels, curtailment of turbines should be implemented for high risk situations.
- A 150m no-turbine set-back buffer zone (infrastructure is allowed) is required around the escarpment to minimise the risk of collisions for slope soaring species.
- Care should be taken not to create habitat for prey species that could draw priority raptors into the area and expose them to collision risk. Rock piles must be removed from site or covered with topsoil to prevent them from becoming habitat for Rock Hyrax (Dassie).
- Restrict the dismantling activities to the footprint area.
- Do not allow any access to the remainder of the property during the dismantling period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- An avifaunal specialist should perform a walk-through of the powerline prior to the commencement of the dismantling activities to identify any raptor nests on the line. Should a nest be discovered, the avifaunal specialist must have input into the dismantling schedule to assess how and which of the dismantling activities can be timed to minimize the disturbance potential to the occupants of the nest.

All the proposed mitigation measures proposed for the other renewable energy facilities within a 35km radius should be implemented:

Umsobomvu Wind Energy Facility

- No infrastructure should be built in the areas identified as HIGH sensitivity.
- There may be a requirement to avoid construction of certain infrastructure during Verreaux's Eagle breeding season (approximately May to September-October). This will be determined by the avifaunal walk through prior to construction and once the infrastructure layout is final.
- All power line linking the turbines and linking turbine strings to the on-site substation should be placed underground.
- The power line linking the site to the Eskom grid will be above ground but must conform to all Eskom standards in terms of bird friendly pole monopole structures with Bird Perches on every pole top (to mitigate for bird electrocution), and anti-bird collision line marking devices (to mitigate for bird collision). It is particularly important that the collision mitigation devices used are durable and remain in place on the line for the full lifespan of the power line. It will be InnoWind/Eskom's responsibility to maintain these devices in effective condition for this period. Systematic patrols of this power line should

be conducted during post construction bird monitoring for the wind energy facility, in order to monitor the impacts, the effectiveness of mitigation, and the durability of the mitigation measures. An avifaunal walk down will need to be conducted to assess the route of this power line once available.

- A final avifaunal walk through should be conducted prior to construction to ensure that all the avifaunal aspects have been adequately managed and to ground truth the final layout of all infrastructure. This will most likely be done as part of the site specific Environmental Management Plan. This will also allow the development of specific management actions for the Environmental Control Officer during construction and training for relevant on site personnel if necessary.
- The post-construction bird monitoring programme outlined by this report should be implemented by a suitably qualified avifaunal. This monitoring should include the grid connection power line.
- The findings of post-construction monitoring should be used to measure the effects of this facility on birds. If significant impacts are identified the wind farm operator will have to identify and implement suitable mitigation measures.

Mainstream Noupoort Wind Energy Facility

- Formal monitoring should be resumed once the turbines have been constructed. The purpose of this would be to establish if displacement of priority species has occurred and to what extent. The exact time when post-construction monitoring should commence, will depend on the construction schedule, and will be agreed upon with Mainstream once these timelines have been finalised.
- The duration of the post-construction monitoring would need to be for at least an equivalent period to the pre-construction monitoring (four seasons), thereafter the need for additional monitoring will be determined and agreed to with Mainstream, based on the results of the first year of post-construction monitoring.
- A 500m buffer has already been implemented in the lay-out to accommodate the Blue Cranes that are breeding on the site. This should be strictly enforced as a no turbine zone for the duration of the project. In addition, no access roads should be constructed within that zone.
- Habitat destruction should be limited to what is absolutely necessary for the construction of the infrastructure, including the construction of new roads. Personnel should be adequately briefed on the need to restrict habitat destruction, and must be restricted to the actual construction area.
- Formal monitoring should be resumed once the turbines have been constructed. The purpose of this would be (a) to establish if displacement of priority species has occurred and to what extent through the altering of flight patterns post-construction, and (b) to search for carcasses at turbines.
- Ensuring that key areas of conservation importance and sensitivity are avoided, in this instance slopes and potential funnels of bird flight activity.
- The proposed power line should be routed as far as possible from high risk areas (e.g. Blue Crane nest, agricultural lands, and dams). In addition, the proposed alignment must be assessed for potential collision risks and those sections must be marked with Bird Flight Diverters.
- The proposed pole design must be assessed by the avifaunal specialist to ensure that the power line design poses no potential electrocution risk of large raptors, particularly Martial Eagle, which may use the poles as hunting perches.
- Once the turbines have been constructed, post-construction monitoring should be implemented as part of the continuation of the current monitoring programme, to assess displacement and actual collision rates. If actual collision and displacement levels are deemed too high, further mitigation measures would need to be considered:
    - Negotiating appropriate off-set compensation for turbine related displacement and collision mortality;

- As a last resort, halting operation of specific turbines during peak flight periods, or reducing rotor speed, to reduce the risk of collision mortality.

San Kraal Wind Energy Facility

- Restrict the construction activities to the construction footprint area.
- Do not allow any access to the remainder of the property during the construction period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Implement a 500m no development buffer zone around each of the two pans at FP3 at 31°14'15.02"S 25° 2'44.17"E and FP4 at 31°13'55.42"S 25° 2'50.37"E to protect the pair of Blue Cranes from disturbance.
- The appointed Environmental Control Officer (ECO) should be trained by an avifaunal specialist to identify the signs that indicate possible breeding by priority species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of such species, and such efforts may include the training of construction staff to identify such species, followed by regular questioning of staff as to the regular whereabouts on site of the species. If any priority species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and the avifaunal specialist will be contacted immediately for further assessment of the situation and instruction on how to proceed.
- The final powerline design and associated electrocution mitigation measures (if necessary) must be approved and signed off by the avifaunal specialist.
- Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates.
- The avifaunal specialist, in consultation with external experts and relevant NGO's such as BLSA, should determine annual mortality thresholds for priority species anticipated to be at risk of collision mortality, prior to the wind farm going operational.
- If actual collision rates exceed the pre-determined threshold levels, curtailment of turbines should be implemented for high risk situations.
- A 150m no-turbine set-back buffer zone (infrastructure is allowed) is required around the escarpment to minimise the risk of collisions for slope soaring species.
- Care should be taken not to create habitat for prey species that could draw priority raptors into the area and expose them to collision risk. Rock piles must be removed from site or covered with topsoil to prevent them from becoming habitat for Rock Hyrax (Dassie).
- The final power line route should be assessed by way of a walk-through and those sections requiring Bird Flight Diverters (BFDs) must be identified.
- Use the Preferred Alternative or Alternative 1 for the grid connection in order to avoid the No-Go zone around the Verreaux's Eagle nest at FP1.
- Restrict the dismantling activities to the footprint area.
- Do not allow any access to the remainder of the property during the dismantling period.
- Restrict the dismantling activities to the footprint area.
- An avifaunal specialist should perform a walk-through of the powerline prior to the commencement of the dismantling activities to identify any raptor nests on the line. Should a nest be discovered, the avifaunal specialist must have input into the dismantling schedule to assess how and which of the dismantling activities can be timed to minimize the disturbance potential to the occupants of the nest.

9.5 Bats

Cumulative impacts on bat mortalities due to direct blade collision or barotrauma during foraging on resident and migrating bats can be mitigated by adhering to recommended mitigation measures during the operational phase study; applying and adhering to project specific mitigations and the sensitivity map during any further turbine layout revisions; avoid placements of turbines in bat sensitive areas and their buffers; lastly the high sensitivity valley areas can serve as commuting corridors for bats in the larger area, potentially lowering the cumulative effects of several WEF's in an area if the valley areas are avoided during turbine placement and are well buffered.

9.6 Visual

- Large construction vehicles and equipment during the construction phase of the Phezukomoya WEF will contribute further to the alteration of the natural character of the study area and will also expose a greater number of visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed Phezukomoya development site on gravel access roads are also expected to result in an increase in dust emissions in the greater area. The increased traffic on these roads and the dust plumes could create a greater visual impact within the greater area and may evoke more negative sentiments from surrounding viewers. Surface disturbance during construction of the Phezukomoya WEF would also result in a greater amount of bare soil being exposed which could result in a greater visual contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the landscape further. Wind blowing over these disturbed areas could result in a greater amount of dust which would have a visual impact.
    - Carefully plan to reduce the construction period.
    - Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
    - Vegetation clearing should take place in a phased manner.
    - Maintain a neat construction site by removing rubble and waste materials regularly.
    - Make use of existing gravel access roads, where possible.
    - Limit the number of vehicles and trucks travelling to and from the proposed Phezukomoya development site, where possible.
    - Ensure that dust suppression techniques are implemented on all access roads.
    - Ensure that dust suppression is implemented in all areas where vegetation clearing has taken place.
    - Ensure that dust suppression techniques are implemented on all soil stockpiles.
    - Temporarily fence-off the construction sites (for the duration of the construction period).
    - All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid, where possible.
    - It is not realistic to attempt to screen wind farms visually. Providing a means whereby they can be absorbed into the landscape is more feasible. This can be approached by making use of certain materials and finishes and by presenting the scheme to I&APs.
    - Institute a rigorous planting regime around certain boundaries of the project site, the proposed substation, ancillary buildings, N10 and N9 transportation routes.
    - Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism (namely sense of place, sense of history, sense of nature, sense of craft and sense of limits).

- The Phezukomoya WEF development and its associated infrastructure could exert a visual impact by further altering the visual character of the surrounding area and exposing a greater number of sensitive visual receptor locations to visual impacts. The operation of the Phezukomoya WEF in addition to the other nearby renewable energy developments may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the Phezukomoya WEF development and its associated infrastructure via gravel access roads and are expected to increase dust emissions in the surrounding area in doing so. The increased traffic on the gravel roads and the dust plumes could create a greater visual impact within the surrounding area and may evoke more negative sentiments from surrounding viewers. It should however be noted that the existing roads which can be found around the project site also appear to be gravel. As such, the gravel access roads are not expected to contribute significantly to the overall cumulative visual impact. Security and operational lighting at the Phezukomoya WEF development and its associated infrastructure could result in a greater amount of light pollution and glare within the surrounding area, which could be a significant annoyance to surrounding viewers.
    - Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity.
    - Medium-high visual impact zones should be viewed as zones where the number of turbines should be limited, where possible.
    - Light fittings for security at night should reflect the light toward the ground (except for aviation lighting) and prevent light spill.
    - The operations and maintenance buildings should not be illuminated at night, if possible.
    - Turbines should be painted plain white, as this is a less industrial colour (Vissering, 2011). Bright colours or obvious logos should not be permitted.
    - Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).
    - The operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
    - If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual impact that would typically be experienced in a chaotic landscapes made up of diverse colours, textures and patterns (Vissering, 2011).
    - As far as possible, limit the number of maintenance vehicles, which are allowed to access the sites.
    - Bury cables under the ground where possible.
    - Ensure that dust suppression techniques are implemented on all access roads.
    - Select the alternatives that will have the least impact on visual receptors.
    - It is not realistic to attempt to screen wind farms visually. Providing a means whereby they can be absorbed into the landscape is more feasible. This can be approached by making use of certain materials and finishes and by presenting the scheme to I&APs.
    - Institute a rigorous planting regime around certain boundaries of the project site, the proposed substation, ancillary buildings, N10 and N9 transportation routes.

9.7 Heritage

The cumulative impact on heritage is the risk of accumulative damage to the National Estate. Given the lack of information at present, it is difficult to judge success of mitigation, and therefore the degree of accumulative impact that has taken place. Methods must be

developed by heritage authorities to assess the success of mitigation action within renewable energy projects.

9.8 Social

- The final placement of wind turbines associated with the proposed WEF's cumulative visual impact associated with the establishment of a WEF on the on the areas rural sense of place and character of the landscape should be discussed with the affected landowners and the recommendations of the VIA should be implemented.
- The establishment of a number of renewable energy facilities has the potential to place pressure on local services, specifically medical, education and accommodation. The Northern and Eastern Cape Provincial Government, in consultation with the ULM and IYLM and the proponents involved in the development renewable energy projects in the ULM and IYLM area should consider establishing a Development Forum to co-ordinate and manage the development and operation of renewable energy projects in the area, with the specific aim of mitigating potential negative impacts and enhancing opportunities. This would include identifying key needs, including capacity of existing services, accommodation and housing and the implementation of an accredited training and skills development programmes aimed at maximising the opportunities for local workers to be employed during the construction and operational phases of the various proposed projects. These issues should be addressed in the Integrated Development Planning process undertaken by the ULM and IYLM.
- The establishment of a number of renewable energy facilities in the region will create employment, skills development and training opportunities, creation of downstream business opportunities. The proposed establishment of suitably sited renewable energy facilities within the ULM and IYLM should be supported.

10 ALIEN INVASIVE MANAGEMENT PLAN

10.1 Purpose of the Alien Invasive Management Plan

The purpose of the Phezukomoya WEF Alien Invasive Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Phezukomoya Wind Energy Facility. The broad objectives of the plan includes the following:

- Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment
- Initiate and implement a monitoring and eradication programme for alien and invasive species
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

10.2 Problem Outline

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use licence as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

10.2.1 Vulnerable Ecosystems and Habitats

Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following:

- Wetlands, drainage lines and other mesic areas
- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc.
- Construction camps and lay-down areas which are cleared or are active for an extended period

10.2.1.1 Wetlands, drainage lines and other mesic areas

There are a number of drainage lines at the site. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas should be minimized and these areas should be checked for alien species more than the surrounding landscape.

10.2.1.2 Cleared and disturbed areas

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion as well as the disturbance created during construction which promoted the germination and establishment of alien plant species.

10.2.1.3 Construction camps and laydown areas

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials

10.3 General Clearing and Guidance Principles

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site should be identified during pre-construction surveys of the development footprint. This may occur simultaneously to other required reaches and

surveys. The clearing plan should then form part of the pre-construction reporting requirements for the site.
- The plan should include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently.
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

10.4 Clearing Methods

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- However care should be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum. Fire is not a natural phenomenon in the area and fire should not be used for alien control or vegetation management at the site.
- The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. http://www.dwaf.gov.za/wfw/Control/

10.5 Use of Herbicide for Alien Control

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines should be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

11 ALIEN PLANT MANAGEMENT PLAN

11.1 Construction Phase Activities

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Construction Phase Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation should be undertaken as the work front progresses – mass clearing should not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas should be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32 m of any wetland, 80 m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only	Monthly
Wetlands and other sensitive areas should remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

11.1.1 Monitoring Actions - Construction Phase

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Pre-construction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

11.2 Operational Phase Activities

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Operational Phase Action	Frequency
Surveys for alien species should be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species should take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation should take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

11.2.1 Monitoring Actions - Operational Phase

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

11.3 Decommissioning Phase Activities

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Decommissioning Phase Action	Frequency
All damaged areas shall be rehabilitated if the infrastructure is removed and the facility is decommissioned	Once off
All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Once off, with annual follow up re-vegetation where required
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

11.3.1 Monitoring Actions - Decommissioning Phase

The following monitoring and evaluation actions should take place during the decommissioning phase of the development

Monitoring Action	Indicator	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Annually for 3 years

12 PLANT RESCUE AND PROTECTION PLAN

12.1 Purpose

The purpose of the plant rescue and protection plan is to implement avoidance and mitigation measures to reduce the impact of the development on listed and protected plant species and their habitats. Although this report identifies those species suitable for search and rescue at the site, it is important to note that a preconstruction walk-through of the site would also be important to refine the list of species identified for search and rescue, as well as locate such species prior to construction.

The objective of rescuing plants on the project area is to prevent the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.

Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.

12.2 Effect of removing individual species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

12.3 Plant Rescue and Protection

Successful plant rescue can only be achieved if:

- Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
- All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
- They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
- Timing of planting activities is planned with the onset of the growing season.
- Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

12.4 Time of Planting

- All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.
- Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas should commence during early spring after the first rains.

12.5 Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the ECO and contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the Re-vegetation and Habitat rehabilitation Plan.

13 RE-VEGETATION AND HABITAT REHABILITATION PLAN

The Revegetation and Habitat Rehabilitation Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site. The plan overlaps to some degree with the Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPs mentioned.

The objective of the plan is therefore to provide:

- Protocols for the removal, temporary storage and replanting of plant species of conservation concern Protocols for the rehabilitation of vegetative cover across the project area
- Tools for planning the rehabilitation work and responding to unforeseen events Guidelines on implementation and post-implementation tasks Criteria for evaluating rehabilitation success
- A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMP-related activities is consistent with the significance of project impacts

The objective of rehabilitation and revegetation of the development area is:

- Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.

- Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
- Preserving or re-creating the structural integrity of natural plant communities. Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.
- Improving the ecosystem function of natural landscapes and their associated vegetation.
- Successful rehabilitation can only be achieved with: »A long-term commitment »Practical, adaptive management »Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved should be consulted to determine:

- What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?
- A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation.
- Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.
- The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

13.1 Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

- Current land cover
  - Roads and residential
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
  - Transformed areas
  - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

- what will happen there
- what needs to be mitigated – including storm water- and erosion management
- which management units need priority intervention/mitigation
- how will this mitigation / intervention be done (method statements) including schedule of work

- realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation
- approximate timeframes
- monitoring protocol to evaluate success or failures of interventions
    - establish permanently marked transects and monitor with fixed-point photography who will be responsible for doing what how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

13.2 Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:

- Stabilisation of soils
- Stabilisation of riparian areas
- Storm water reduction through management and wetland integrity
- Clearing of IAPs
    - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
- Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely

13.3 Remove or ameliorate the cause of degradation

This will include:

- Physical rehabilitation of topsoil where it has been removed.
- Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and – fauna essential for nutrient cycling processes. Topsoils are also important source of seeds.
- Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils.
- Stabilisation of topsoils and prevention of erosion – refer to the Erosion management plan.
- Removal of all invasive vegetation – refer to the Alien Invasive Management Plan
    - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers

13.4 Initial Revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion

stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

13.5 Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species should be re-introduced, seed should be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover should resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

13.5.1 For drainage areas

- First restore drainage line morphology following the guidelines of the Erosion Management Plan – without that ecological recovery cannot be initiated
- Determine if natural seed sources may be present further upstream
- If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
- Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

13.6 Monitoring and follow-up action

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that should be monitored:

- Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state

- Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
- Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
- Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting
  - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

13.7 Timeframes and duration

- Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
- The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
- The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
- If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until an acceptable plant cover is achieved (excluding alien plant species or weeds).
- Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
- Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
- Succession of natural plant species should be encouraged
- Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

14 OPEN SPACE MANAGEMENT PLAN

The objective of open space management is to restore, enhance and rehabilitate open spaces, improve climate change adaptations through the minimisation of biodiversity loss, and mitigate against environmental degradation. Management actions consider open spaces and natural areas as well as community perceptions of these.

In the context of the proposed grid connections and substations the primary purpose of the open plan management plan is therefore to:

- Minimise visual impact on the character of the area; and
- Maintain biodiversity within the area to ensure that no long-term negative impacts occur on the local environment.

The proposed grid connections and associated infrastructure has the potential to impact negatively on the character of the area, as identified in the Visual Impact Assessment conducted during the EIA phase. The following actions must be implemented to minimise this visual impact:

- Grid connection route to avoid visually sensitive peaks, major ridgelines, scarp edges and slopes steeper than 1:5 gradient
- Substation to be sited in unobtrusive low-lying areas, away from roads and habitations, and screened by berms and/or tree-planting where feasible.
- Operations and maintenance buildings and parking areas to be located in an unobtrusive area and consolidated to avoid sprawl of buildings in the open landscape.
- Access roads to be in sympathy with the contours, avoid steep 1:5 slopes and drainage courses, and kept as narrow as possible.
- Access and haul roads to use existing farm tracks as far as possible.
- Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.
- Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential.
- Measures to control wastes and litter to be included in the contract specification documents.
- Provision to be made for rehabilitation / re-vegetation of areas damaged by construction activities.

In order to maintain biodiversity, the Alien Invasive, Plant Rescue and Protection and Re-vegetation and Habitat Management Plans must be adhered to.

In addition, the following actions should be implemented by the Contractor and Project Company:

- Promote environmental awareness in all employees and sub-contractors and create an understanding of the environmental sensitivities of the project site;
- No waste, including organic matter may be disposed of anywhere on site, except in provided bins placed at convenient locations, especially during the construction period. Disciplinary actions should be taken against littering;
- Open spaces are to be kept free of alien plants and weeds;
- Indigenous plants may not be collected or removed from the site;
- Access to the facility should be strictly controlled;
- All visitors and contractors should be required to sign-in;
- Signage at the entrance should indicate that disturbance to fauna and flora is strictly prohibited.

The following activities should not be permitted by anyone except the landowner or his representatives:

- No fires within the site
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
- No driving off of demarcated roads
- No interfering with livestock

14.1 Grazing Management

The development of the wind energy facility will not prevent the site from being used for its current landuse of extensive livestock production. Extensive livestock grazing is compatible with biodiversity maintenance provided that it is implemented according to the

basic principles of sustainable grazing management. While the majority of these are beyond the scope of the current plan, the following basic principles should be adhered to:

- A grazing management plan for the site should be developed in cooperation with Agricultural Extension services.
- The stocking rate applied should be within the recommended limits as identified by the Department of Agriculture.
- Livestock should be rotated through the different paddocks at the site in a manner which allows for the growth and recovery of the vegetation between grazing events.
- Precautions should be taken to ensure that the development of the site does not increase the risk of stock theft within the facility. These include access control as previously described, as well as security patrols.

15 TRAFFIC MANAGEMENT PLAN

The objective of the traffic management plan is the prevention of incidents from the use of vehicles and disturbance of local traffic on public roads during the construction, operation and decommissioning phases of the proposed projects. Traffic volumes are most likely to increase during the construction phase. However, due to the remote location of the site, and the low volume of traffic on public roads in the area the impact is expected to be low.

A specialist study was conducted to determine, what impact, if any the proposed development will have on the existing traffic in the area.

The report had the following recommendations:

- Access point D and B is recommended as the access position, based on safety considerations (Figure 15.1 - 15.3)
- The preferred access road is recommended to be the N10 from PE to Middelburg, the N9 from Middelburg to Noupoort to access point B and then the R389 from Noupoort to access point D.
- A comprehensive route assessment of the entire route is recommended should the project be awarded preferred bidder as part of the REIPPP process.
- It is recommended that the access points be stop controlled and widened to allow for dedicated right turn and left turn lanes off the main road, which will incorporate the turning circles of the expected abnormal vehicles.
- Access point B off the N9 will require clear warning road markings and signs as well as acceleration and deceleration lanes on the N9 on the approaches to and from Access B.
- In addition, allowance must be made for public transport vehicle lay byes on both sides of the accesses along the main road as well as safe pedestrian crossings on all 3 approaches of the access.
- Clearances will be required for the transport of the WT components.
- It is recommended that applications for Abnormal Permits be lodged to the Department of Transport and Public Works, Eskom and Telkom.

Actions to be implemented by the Contractor and Project Company:

- Site-specific traffic plan to be developed and implemented during the detailed design phase prior to construction;
- Limit use of private cars by arranging mini bus transport service for workers;
- Monitor for overloading of vehicles;
- Use only well trained, suitably qualified and experienced drivers in possession of an appropriate and valid driver's license;
- All vehicles must be roadworthy and serviced regularly;
- Clear and visible signage must be placed on and around site, clearly demarcating safe entry and exit points;

- Require all drivers to abide by standard road and safety procedures on site;
- When travelling on public roads all speed limits and rules of the road must be adhered to; and
- Limit dust generation by applying dust suppressants and postponing dust generating activities during period of strong winds and enforcing a strict speed limit of 40 km/h on unpaved roads.

Monitoring actions to be conducted by the ECO

- Maintain incidents / complaints register for community complaints;
- Monitor dust generation and implementation of management actions detailed above.

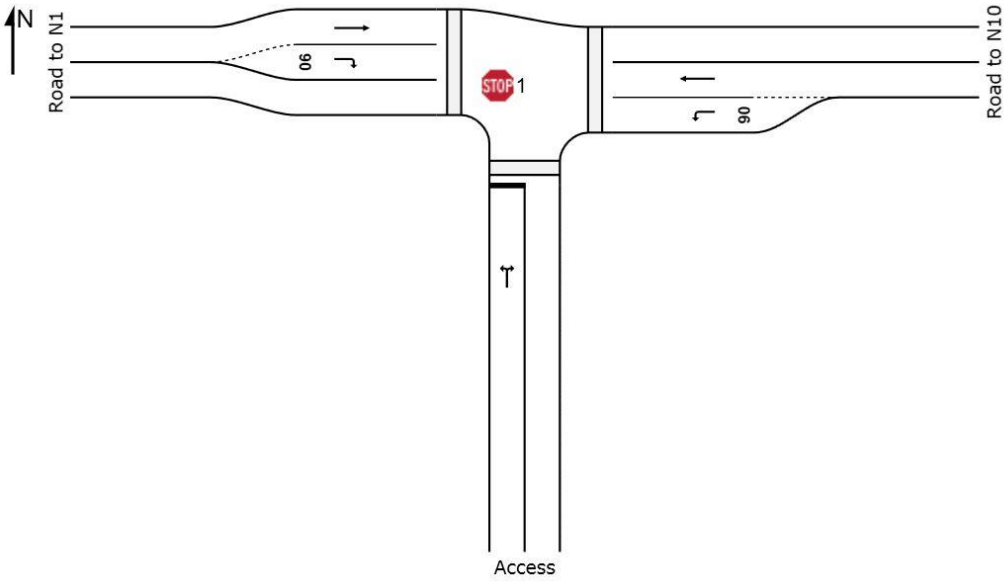


Figure 15.1 Site Access Option for Access D

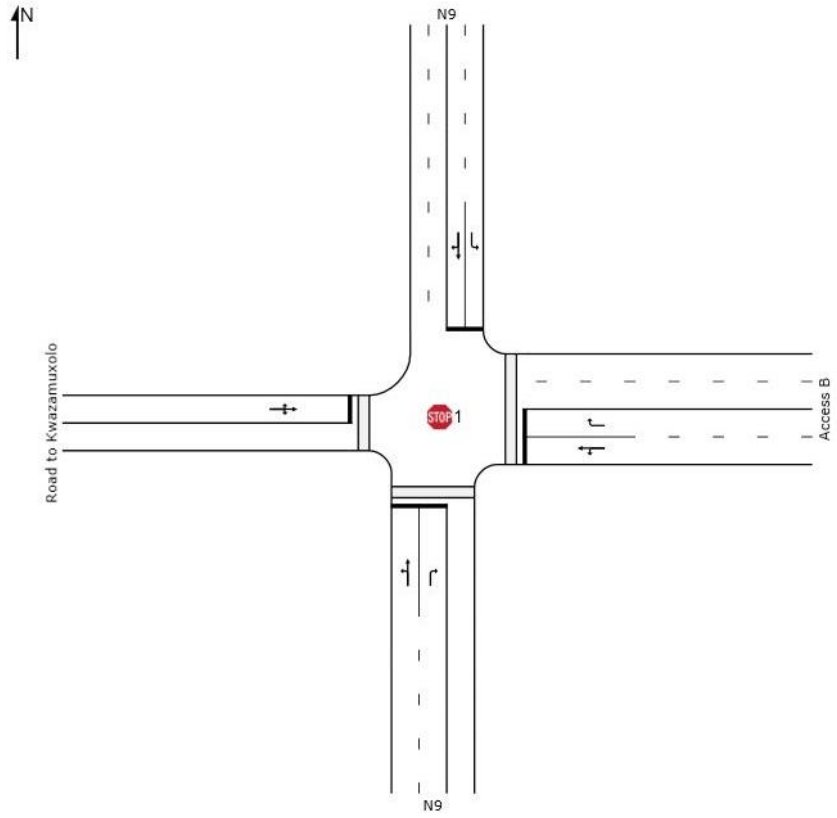


Figure 15.2: Site Access Option for B

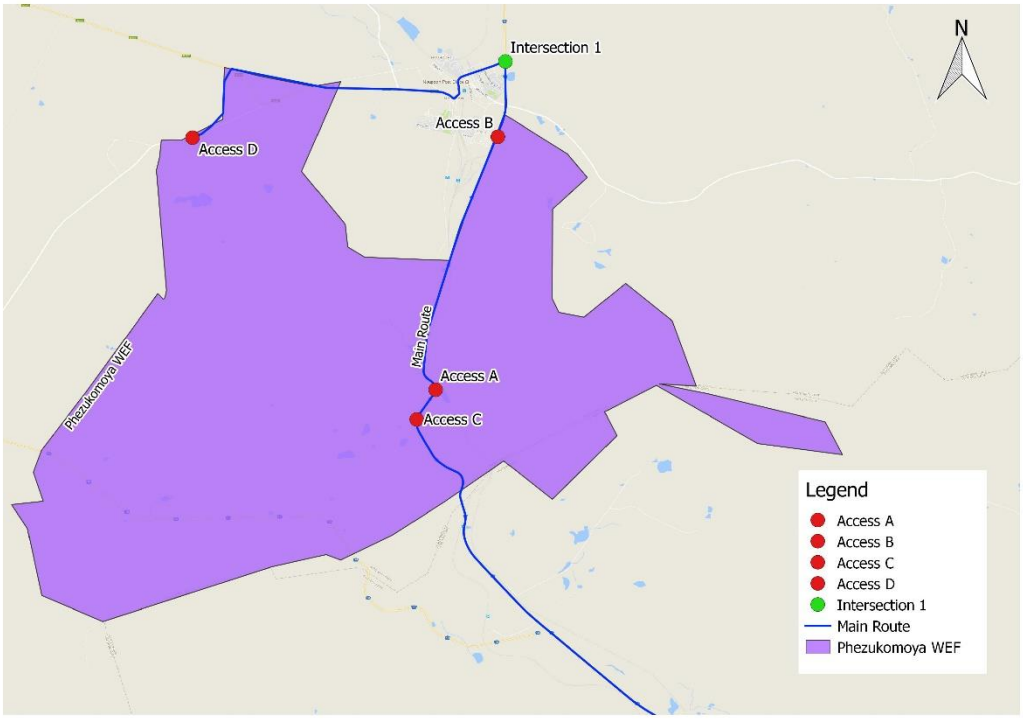


Figure 15.3: Site Access Options to Phezukomoya WEF

16 TRANSPORTATION MANGEMENT PLAN

The Transportation Management Plan aims to ensure the safe transportation of all components required for the construction of the proposed project to the construction site. This includes the turbines, substation transformers, electrical cables and pylon structures.

As part of the Traffic Management Study that was undertaken for the development, the following regarding transportation management must be considered and implemented:

Transport requirements for the WEF project will require the use of abnormal load vehicles as stipulated in the TRH 11, especially in the construction phase of the project for the delivery of construction materials and turbine components. Very little to no special transport will be required during the remainder of the development phases as standard transport will be used.

All WT components are considered to be abnormal loads, either through length, weight or height, usually comprising of 3 tower sections, 1 hub, 1 nacelle and 3 blades. These require different truck / trailer combinations and configurations to be transported. These issues will be investigated at a later stage when the transporting contractor and the plant hire companies apply for the necessary permits from the permit issuing authorities. The heaviest component of a wind turbine is the nacelle (approximately 67 to 85 tons depending on manufacturer and design of the unit). Combined with road-based transport, it has a total vehicle mass of approximately 130 000 kg (for the 85 ton unit). Thus route clearances and permits will be required for transporting the nacelle by road based transport.

Blades are the longest component, ranging between 45 – 75 m, and need to be transported on a specially imported extendible blade transport trailer or in a rigid container with rear steerable dollies. The blades can be transported individually, in pairs or in three's although different manufacturers have different methods of packaging and transporting the blades. Where required, existing public roads may need to be upgraded along the proposed equipment transport route to allow for the transportation and delivery of wind turbine components and other associated infrastructure components. The national roads on the potential national access routes are generally of high standard and many of the structures have been assessed for load bearing capacity and height clearance in the past. Turbine supplier/s or the contractor selected for implementation would be responsible for the transportation of wind turbine components to site. A complete transportation management plan will be undertaken prior to construction, should the project be awarded preferred bidder status.

16.1 Permit requirements

In transportation of loads the following guidelines are available. According to the TRH 11, the expected load dimensions are classified as abnormal load, therefore an exemption permit for each province that the load has to transit is required.

Provision for the type of abnormal loads in this development is made in the National Road Transport Act (NRTA), and specifically in Section 81 of the NRTA, which reads as follows:

"Vehicle and load may be exempted from provisions of Act

An MEC may, subject to such conditions an upon payment of such fees or charges as he or she may determine, authorise in writing, either generally or specifically, the operation on a public road of a vehicle which does not comply with the provisions of this Act or the conveyance on a public road of passengers or any load otherwise that in accordance with the provisions of this Act."

When the movement of an abnormal load is considered to be in the economic and/or social interest of the country, an exemption permit may be issued to allow a vehicle(s)

transporting such an abnormal load to operate on a public road for a limited period. The fundamental principles guiding this process are:

- An exemption permit for an abnormal load will only be considered for an indivisible load, abnormal in dimension and/or mass, where there is no possibility of transporting the load in a legal manner.
- The risks to other users must be reduced to a level equivalent to what it would be without the presence of the abnormal vehicle on the road; and
- The conditions imposed must take the economic and/or social interest of the country and public at large into account.

16.2 Types of Abnormalities

The WEF is anticipated to carry loads that are considered to be indivisible, can be abnormal either dimensionally or abnormal in mass or abnormal both dimensionally and in mass.

The following is the Legally Permissible Maximum Dimensions / Mass:

Length- Truck & Semi-trailer (Tri-Axle) Overall length of combination (Including load projections) -18.50m. Superlink (6m + 12m trailers) Overall length of combination (No load projections) –22.00m.

Width -2.60 m.

Height- 4.30 m measured from the ground. Height of conventional trailer is 1.60m from ground to trailer deck, therefore permissible height of load is 2.70m.

Weight 13.50m Tri-Axle 28 Ton / 15.00m Tri-Axle 30 Ton. Superlink 34 Ton gross (6.00m –10 / 12 Ton & 12m –24 / 22 Ton)

The WEF components are classified as an Abnormal Load and will necessitate the application to the Department of Transport and Public Works for a permit authorising the conveyance of said load.

With the required permits in place, the following escort vehicles (whether it is the clients own escort vehicles or provincial traffic officer) will be necessary to escort the transportation of abnormal loads. The anticipated escort vehicles are presented in Table 16-1.

It must be noted Loads with a height of 4.70m measured from the ground require –1 x Own Escort vehicle. For loads of 5.50m + high Telkom & Eskom Clearances are required for the lifting of overhead lines. Upon final selection of WT models to be used, the exact amount of escort vehicles can be determined.

Table 16-1: Escort Vehicles

	Details	**Escort Vehicles**
Tower	Length: 150 m	3 Tower sections/WT 2 x Provincial Traffic Escorts (subject to width of load)
Rotor	Blade Length: 75 m Hub	3 Blades/WT Connected to 1 Hub/WT 2 x Provincial Traffic Escorts (subject to width of load)

16.3 SANRAL CONSULTATION

- Sanral's Western Region (head office in Cape Town, Western Cape) is responsible for the section of the N9 where the access is proposed (the access is located in the Northern Cape). The project manager of this section of the N9 is Mr. Deriek Wilson - 021 957 4600.
- The applicant needs to submit the traffic impact assessment completed for the San Kraal EIA as well as a plan indicating existing intersections and layouts, as well as planned intersections and proposed layouts to SANRAL for approval should the project be awarded as a preferred bidder.
- This needs to be submitted to SANRAL's statutory control section – Ms. Colene Runkel (runkelc@nra.co.za)
- SANRAL may then request additional information as required.
- Sanral's Southern Region (head office in Port Elizabeth, Eastern Cape) will be responsible for the remainder of the N9 route to/from the site and Port Elizabeth and will have to be consulted for any route determination requirements, which are not included in this scope of works. The project manager for the N9 between Graaff-Reinet and Carlton Heights is Mr. Danford Adams - 041 398 3200.

The following actions should be implemented by the developer and Contractor:

- Apply for all relevant permits for abnormal loads and route clearances with the relevant authorities prior to construction;
- Appoint a qualified specialist to conduct a detailed site-specific Transport Risk Assessment during the detailed design phase and prior to construction;
- Determine the pre-construction condition of the road immediately prior to construction by carrying out a condition assessment or from recent pavement management system condition assessments if available from the Provincial Authorities;
- Public notices regarding any planned abnormal load transports must be placed at the construction site to inform affected parties;
- Abnormal loads must conform with legal maximum dimensions, and vehicles carrying abnormal loads must display sufficient signage;
- Any roads damaged during the transportation of components, or from other construction vehicles must be rehabilitated and returned to pre-construction conditions.

The following monitoring activities should be carried out by the ECO:

- Conduct site audits and report non-compliance with the above-mentioned conditions

17 STORMWATER MANAGEMENT PLAN

The objective of the storm water management plan (SWMP) is to prevent increased soil erosion, to contain any contaminated run-off and to avoid water logging and pollution. The Erosion Management Plan (see below) must therefore be seen in conjunction with the SWMP. Actions are listed that will ensure that storm water is channelled in a controlled manner from roads and substations towards natural drainage lines, without impeded natural surface flows.

- Develop and implement a site-specific storm water management plan during the detailed design phase of the projects and prior to construction;
- In the detailed design phase of the project minimise any water crossings and utilise existing roads wherever possible;
- Enforce 32 m construction buffers of all rivers, streams and waterbodies;
- Should new roads be required to cross any banks or channels these must be secured with erosion protection (i.e. gabions etc.);
- Monitor for erosion during the clearing of vegetation;

- Avoid hard-engineered surfaces (i.e. construct gravel roads and not asphalt roads wherever possible);
- Roads in steep areas must be equipped with side drainages and culverts that channel the run-off to natural drainage lines without gaining velocity and causing erosion;
- Construction camps and temporary ablution facilities must be located beyond the 1:100 year flood line;
- Stockpiles must be located on flat areas and protected from erosion;
- The substation site design must include side water outlets and an adequate slope to allow storm water run-off from the paved areas;
- Prevent surface run-off from areas of potential contamination

18 EROSION MANAGEMENT PLAN

18.1 Purpose

The purpose of the erosion management plan is to implement avoidance and mitigation measures to reduce the erosion potential and the likely impact of erosion associated with the construction and operational phases of the proposed facility. As part of the management plan, measures to protect hydrological features from erosion damage are included.

18.2 Scope and Limitations

This plan is intended at introducing measures aimed at reducing the negative impacts of erosion on biodiversity as well as reducing the vulnerability of the site to erosion problems during the construction and operational phases of the development. The focus is on managing runoff and reducing the construction phase impact on ecologically sensitive areas. The plan does not cover engineering-side issues which are of relevance to soil management and erosion. Therefore, issues such as the potential presence of heaving clays, compressible soils, perched water tables, dispersive soils and corrosive groundwater at the site are beyond the general scope of this study and are not directly dealt with. These issues would need to be addressed and their relevance assessed during detailed geotechnical investigation of the site.

18.3 Background

18.3.1 Types of Erosion

Erosion comes in several forms, some of which are not immediately obvious. The major types of erosion are briefly described below:

Raindrop impact

This is the erosion that occurs due to the "bomb blast" effect of raindrop impact. Soil particles can be blasted more than a meter into the air. Apart from loosening soil particles, the effect can also break soil aggregates apart and form a clay seal on the surface which resists infiltration and results in increased levels of runoff. This effect is most important when large areas of exposed soils are present. If the site is cleared, then this effect will play an important role as it results in the soil surface becoming sealed which reduces infiltration and increases runoff, leading to erosion.

Sheet Erosion

This is the removal of a shallow and uniform layer of soil from the surface. It is caused initially by raindrop splash and then by runoff. Sheet erosion is often difficult to see as no perceptible channels are formed. Accumulated sediment at the bottom of the slope is often

the only indicator. This is likely to be an important erosion type at the site given the gently sloping nature of the site and the susceptible soils.

Rill Erosion

This is the removal of soil from the surface whereby small channels or rills up to 300 mm are formed. It is caused by runoff concentrating into depressions, wheel tracks etc.

Gully Erosion

This is the removal of soil from the surface and sub-surface caused by concentrated runoff eroding channels greater than 300mm deep. Gully erosion often begins as rill erosion.

Wind Erosion

Wind erosion results from soil particles being picked up, bounced or moved by the wind. Wind erosion is primarily a problem in arid areas and may affect sands soils as well as fine-textured soils. Vegetation cover is usually an effective barrier to wind erosion, but large soils losses or degradation can occur in disturbed areas or on croplands.

18.3.2 Promoting Factors

Rainfall characteristics

High-intensity, short-duration storm events have much greater erosion potential than low intensity, longer duration storm events with the same runoff volume. Intense storms produce larger raindrops, and are more likely to break up the soil and dislodge particles.

Soil erodibility

Soil erodibility is determined by the soils ability to resist detachment and transport due to rainfall, runoff and infiltration capacity. Well-structured soils with a high clay content are generally least erodible. Some clays are dispersible meaning that they break down when wet and become highly erodible. Silts and fine sands are highly erodible.

Length and Steepness of Slope

Steeper slopes cause runoff velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increases.

Soil Surface Cover

Soil surface cover such as vegetation and mulch protect the soil surface from raindrop impact, reduce flow velocity, disperse flow, and promote infiltration and the deposition of sediment. This is a basic principle underlying many erosion control approaches which aim to modify the surface characteristics in order to reduce the flow velocity and reduce the potential for erosion. In this regard it is important to note that many of the practices which are used to enhance rehabilitation potential are also useful in reducing erosion potential.

18.3.3 Erosion and Sediment Control Principles

The goals of erosion and sediment control during and after construction at the site should be to:

- Protect the land surface from erosion;
- Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment.

- Progressively revegetate or stabilise disturbed areas.
- Prevent damage to hydrological features such as drainage lines or wetlands, either within or adjacent to the site.

These goals can be achieved by applying the following principles:

1. Integrate project design with site constraints.
2. Plan and integrate erosion and sediment control with construction activities.
3. Minimise the extent and duration of disturbance.
4. Control stormwater flows onto, through and from the site in stable drainage structures.
5. Use erosion controls to prevent on-site damage.
6. Use sediment controls to prevent off-site damage.
7. Control erosion and sediment at the source.
8. Stabilise disturbed areas promptly.
9. Inspect and maintain control measures.

18.3.4 On-Site Erosion Management

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, the erosion management plan and the revegetation and rehabilitation plan should be closely linked to one another and should not operate independently, but should rather be seen as complementary activities within the broader environmental management of the site and should therefore be managed together.

General factors to consider regarding erosion risk at the site includes the following:

- Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional unseasonal showers can also however cause significant soil loss. Therefore, precautions to prevent erosion should be present throughout the year.
- Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilization. Therefore, the gap between construction activities and rehabilitation should be minimized. Allied to this the fact that topsoil does not store well and should preferably be used within a month or at most within 3 months to aid in the revegetation and rehabilitation of disturbed areas.
- Phased construction and progressive rehabilitation are important elements of the erosion control strategy.
- The extent of disturbance will influence the risk and consequences of erosion. Therefore, large areas should not be cleared at a time, especially in areas such as slopes where the risk of erosion is higher.

18.4 Concentration of flows into downstream areas

Road crossings over drainage lines, streams and wetlands can impact downstream wetland ecosystems. Crossings that result in narrowing of the downstream system can result in concentration of flows and channelisation downstream. This may result in a loss of wetland function, and result in the drying out and shrinkage of the wetland area. Erosion and increased vulnerability to invasion of drier banks by alien vegetation may occur.

- Culverts should be adequately spaced such that they do not result in shrinkage of downstream wetlands. Where roads cross minor drainage channels, a single culvert may be adequate, aligned with the downstream drainage line. Where more substantial wetland systems are intercepted by a road, sufficient culverts should be provided such that downstream shrinkage of wetland width does not occur.

Moreover, culverts should be aligned, as far impossible, with existing, natural channels.
- All crossings of drainage systems should ensure that both surface and shallow subsurface flows can be accommodated where appropriate and that unnatural channelisation does not occur downstream.

18.5 Runoff Concentration

The increase in hardened surfaces associated with roads, and other infrastructure will lead to a significant increase in volume and velocity of flow generated from these areas during large rainfall events.

Runoff from road surfaces is usually channelled off of the road surface towards the downslope side of the road. On steep slopes, the volumes and velocity of runoff generated may result in erosion of the surrounding areas. Therefore, specific measures to curb the speed of runoff water is usually required in such areas, such as rock beds or even gabions. In addition, these areas should be monitored for at least a year after construction to ensure that erosion is not being initiated in the receiving areas. Once erosion on steep slopes has been initiated, it can be very difficult to arrest.

18.5.1 Diversion of Flows

Diversion of flows from natural drainage channels may occur when roads interrupt natural drainage lines, and water is forced to run in channels along the manipulated road edge to formalized crossing points. Even slight diversion from the natural drainage line can result in excessive downstream erosion, as the new channel cuts across the slope to reach the valley bottom. Should the access road to the site traverse any major drainage lines, the following principles should apply:

- Adequate culverts should be provided along the length of all roads to prevent diversion of flow from natural drainage lines.
- Culverts should be carefully located, such that outlet areas do in fact align with drainage lines.
- The downstream velocity of runoff should be managed, such that it does not result in downstream erosion – on steep slopes, where roads have been constructed on cut areas, allowance should be made for culverts to daylight sufficiently far down the slope that their velocities are managed and erosion does not occur.
- Where necessary, anti-erosion structures should be installed downstream of road drains – these may comprise appropriate planting, simple riprap or more formal gabion or other structures.
- Roads and their drainage system should be subject to regular monitoring and inspection, particularly during the wet season, so that areas where head cut erosion is observed can be addressed at an early stage.

18.6 Monitoring Requirements

18.6.1 Construction Phase

The following monitoring actions should be implemented during the construction phase of the development

Monitoring Action	Indicator	Timeframe
Identify all river and drainage line crossings affected by the development	Map of sites of potential concern	Preconstruction

Monitor cleared areas for erosion problems	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor vegetation clearing activities near sensitive areas such as wetlands or drainage lines	Activity log of monitoring actions and any mitigation and avoidance measures implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor revegetated and stabilised areas	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise

18.6.2 Operational Phase

The following monitoring actions should be implemented during the operational phase of the development:

Monitoring Action	Indicator	Timeframe
Monitor for the development of new erosion problems across the site, with a focus on areas where water has been diverted or collected from upslope onto downslope areas	Map of erosion problem areas	Quarterly
Document erosion control measures implemented	Records of control measures and their success rate.	Quarterly
Document the extent of erosion at the site and the remedial actions implemented	Decline in erosion and vulnerable bare areas over time	Biannually

19 FIRE MANAGEMENT PLAN

The National Veld and Forest Fires Act states that it is the landowner's responsibility to ensure that the appropriate equipment as well as trained personnel are available to combat fires.

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

- Lightning strikes
- The railway line which runs in a north – south direction to the site
- Personnel within the facility
- Infrastructure such as transmission lines

19.1.1 Firebreaks

Extensive firebreaks are not recommended as a fire risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management should be implemented around vulnerable or sensitive elements of the facility such as substations or other high risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is recommended that firebreaks are created by mowing

and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substations, a strip of vegetation 5 - 10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However, if alien species colonise these areas, more regular clearing should be implemented.

20 BAT MANAGEMENT PLAN

Currently the most effective method of mitigation, after correct turbine placement, is alteration of blade speeds and cut-in speeds under environmental conditions favourable to bats.

A basic "6 levels of mitigation" (by blade manipulation or curtailment), from light to aggressive mitigation is structured as follows:

1. No curtailment (free-wheeling is unhindered below manufacturer's cut in speed so all momentum is retained, thus normal operation).
2. Partial feathering (45 degree angle) of blades below manufacturer's cut-in speed in order to allow the free-wheeling blades half the speed it would have had without feathering (some momentum is retained below the cut in speed).
3. Ninety degree feathering of blades below manufacturer's cut-in speed so it is exactly parallel to the wind direction as to minimize free-wheeling blade rotation as much as possible without locking the blades.
4. Ninety degree feathering of blades below manufacturer's cut-in speed, with partial feathering (45 degree angle) between the manufacturer's cut-in speed and mitigation cut-in conditions.
5. Ninety degree feathering of blades below mitigation cut in conditions.
6. Ninety degree feathering throughout the entire night.

It is recommended that curtailment be applied from the start of operation at Level 3 on all turbines for every night of the year from dusk until dawn.

Should robust and scientifically defendable data gathered during the operational study phase reveal higher bat mortalities than currently anticipated, the mitigations in Table 20-1 should be applied to the turbines identified as causing the highest impacts. Such curtailment specified in Table 20-1 will have to be at a maximum of Level 5. The turbine layout avoids all High and Moderate bat sensitivities and their buffers.

Table 20-1 below is based on the passive data collected. They infer mitigation be applied (only when needed as described above) during the peak activity periods and times, and when the advised wind speed and temperature ranges are prevailing simultaneously, considering conditions in which 80% of bat activity occurred (normalised data). Bat activity at 50m height were used, with wind speed data at 50 m and temperature data at 37.5 m.

Table 20-1: The periods and weather conditions for implementation of mitigation

	Terms of mitigation implementation
Peak activity (times to implement curtailment/ mitigation)	1 - 31 October; sunset – 00:00 (midnight)

Environmental conditions in which to implement curtailment/ mitigation	Wind speed below 7m/s *and simultaneously* Temperature above 14.5°C
Peak activity (times to implement curtailment/ mitigation)	15 February – 31 March; sunset – 00:00 (midnight)
Environmental conditions in which to implement curtailment/ mitigation	Wind speed below 6.5m/s *and simultaneously* Temperature above 15.5°C

21 AVIFAUNA MANAGEMENT PLAN

The avifauna monitoring and management plan must be implemented during the construction and operation of the facility. This plan must be drafted by a suitably qualified avifauna specialist.

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
Displacement of priority species due to disturbance during construction operations	1) A site-specific Environmental Management Plan (EMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during construction. 2) Environmental Control Officer (ECO) to oversee activities and ensure that the site-specific EMP is implemented and enforced via regular inspections. 3) The ECO must be trained by the avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an	ECO and Avifaunal specialist	Construction	Yes	If a priority species nest is discovered during the construction phase, the ECO must conduct weekly inspections of the nest to monitor the breeding effort, in consultation with the avifaunal specialist.

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
	avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. 4) Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding/roosting activity of priority species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. 5) During the construction phase, the avifaunal specialist must conduct surveys/exploration of the WEF site (particularly focussing on potential Verreaux's Eagle roost sites as well as suitable nesting habitat). This should be done during and after, the breeding season (i.e. approximately in July and again in September). The aim will be to locate any new nest sites, so that these may be monitored during the construction and operational phase.				
Displacement of priority species due to habitat transformation during construction phase	1) A site-specific Environmental Management Plan (EMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of	ECO Avifaunal specialist Rehabilitation specialist	Construction	Yes	ECO to oversee activities and ensure that the site-specific EMP is implemented and enforced via regular inspections;

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
	habitat. All contractors are to adhere to the EMP and should apply good environmental practice during construction. EMP should include the following: • Existing roads and farm tracks should be used where possible; • The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths; • No off-road driving; • ECO to hold regular inspections ensure that the EMP is implemented and enforced; • Any clearing of stands of alien trees on site should be approved first by the avifaunal specialist. • Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist and included within the EMP.				

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
Priority species mortality due to collisions with the turbines	1) Mortality thresholds should be determined by the avifaunal specialist in consultation with BirdLife SA, for priority species recorded during the pre-construction monitoring, prior to the wind farm becoming operational. 1) Once the turbines have been constructed, operational monitoring should be implemented under the guidance of an avifaunal specialist to assess collision rates, in accordance with the latest version of the Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. 3) If collision rates indicate mortality exceeding threshold levels of priority species, curtailment must be implemented during high risk periods. These periods, and the number of turbines to be curtailed, will be determined by the avifaunal specialist in consultation with the wind farm management. 4) Regular inspections must be conducted by the ECO to ensure that rock piles are removed from site or covered with topsoil to prevent them from becoming habitat for Rock Hyrax (Dassie)*Procavia capensis.*	Wind farm management, ECO, and avifaunal specialist (in consultation with BirdLife SA)	Operational	Yes	Once the turbines have been constructed, operational monitoring should be implemented under the guidance of an avifaunal specialist to assess collision rates, in accordance with the latest version of the Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.
Priority species mortality due to collision with the on-site powerlines	1) An avifaunal specialist must conduct a site walk through of final pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required.	Avifaunal specialist	Operational	Yes	The operational monitoring programme must also include quarterly monitoring of the overhead power lines for collision mortalities.

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
	2) Bird flight diverters must be installed as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. 3) The operational monitoring programme must include quarterly monitoring of all overhead power lines for collision mortalities, with a view to mark additional spans with BFDs if necessary.				
Priority species mortality due to electrocution on the on-site powerlines	1) An avifaunal specialist must certify that the pole structures to be used on the internal MV network is bird-friendly.	Avifaunal specialist	Design	Yes	The operational monitoring programme must also include quarterly monitoring of the overhead power lines for electrocution mortalities.
Displacement of priority species due to disturbance during decommissioning operations	1) A site-specific Environmental Management Plan (EMP) must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted to reduce unnecessary destruction of habitat. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning. 2) Following decommissioning, rehabilitation of all areas disturbed must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist and included within the Environmental Management Plan (EMP).	Site management Rehabilitation specialist	Decommissioning	Yes	None

22 NOISE MANAGEMENT PLAN

Environmental Noise Measurement can be divided into two distinct categories, namely:

- Passive measuring – the registering of any complaints (reasonable and valid) regarding noise; and
- Active measuring – the measurement of noise levels at identified locations.

No active environmental noise monitoring is recommended due to the low significance for a noise impact to develop. However, should a reasonable and valid complaint about noise be registered, it is the responsibility of the developer to investigate this complaint as per the following sections. It is recommended that the noise investigation be done by an independent acoustic consultant.

While this section recommends a noise monitoring programme, it should be used as a guideline as site specific conditions may require that the monitoring locations, frequency or procedure be adapted.

22.1 Measurement Localities and Procedures

22.1.1 Measurement Localities

No routine noise measurements or locations are recommended. Noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. A second instrument must be deployed at a control point away from the potential noise source during the measurement period.

22.1.2 Measurement Frequencies

Once-off measurements if and when a reasonable and valid noise complaint is registered. Results and feedback must be provided to the complainant. If required and recommended by an acoustic consultant, there may be follow-up measurements or a noise monitoring programme can be implemented.

22.1.3 Measurement Procedures

Ambient sound measurements should be collected as defined in SANS 10103:2008. Due to the variability that naturally occurs in sound levels at most locations, it is recommended that semi-continuous measurements are conducted over a period of at least 24 hours, covering at least a full day- (06:00 – 22:00) and night-time (22:00 – 06:00) period. Measurements should be collected in 10-minute bins defining the 10-minute descriptors such as $L_{Aeq,I}$ (National Noise Control Regulation requirement), $L_{A90,f}$ (background noise level as used internationally) and $L_{Aeq,f}$ (Noise level used to compare with IFC noise limit). Spectral frequencies should also be measured to define the potential origin of noise. When a noise complaint is being investigated, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise event.

22.2 Relevant Standard for Noise Measurements

Noise measurements must be conducted as required by the National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008. It should be noted that the SANS standard also refers to a number of other standards.

22.3 Data Capture Protocols

22.3.1 Measurement Technique

Noise measurements must be conducted as required by the National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008.

22.3.2 Variables to analysed

Measurements should be collected in 10-minute bins defining the 10-minute descriptors such as LAeq,I (National Noise Control Regulation requirement), L¬A90,f (background noise level as used internationally) and L¬Aeq,f (Noise level used to compare with IFC noise limit). Noise levels should be co-ordinated with the 10-m wind speed. Spectral frequencies should also be measured to define the potential origin of noise.

22.3.3 Database Entry and Backup

Data must be stored unmodified in the electronic file saved from the instrument. This file can be opened to extract the data to a spread sheet system to allow the processing of the data and to illustrate the data graphically. Data and information should be safeguarded from accidental deletion or corruption.

22.3.4 Feedback to Receptor

A measurement report must be compiled considering the requirements of the National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008. The facility must provide feedback to the potential noise-sensitive receptors using the channels and forums established in the area to allow interaction with stakeholders, alternatively in a written report.

22.4 Standard Operating Procedures for Registering a Complaint

When a noise complaint is registered, the following information must be obtained:

- Full details (names, contact numbers, location) of the complainant;
- Date and approximate time when this non-compliance occurred;
- Description of the noise or event;
- Description of the conditions prevalent during the event (if possible).

23 FUEL STORAGE MEASURES

23.1 Storage Tanks

The storage tanks will be within contained areas to prevent spills contaminating soil and water, and with a design to capture and contain a volume of spill of at least 110% of the volume of stored fuel. These containers can be built in concrete and painted with anti-corrosive paint. The floor of the container must be inclined to permit the collection of the spilled liquids.

The storage tanks must also have a cover protection on top, prepared for drainage and collection of runoff.

23.2 General Procedures

- Transport routes for the transport of fuel will be clearly indicated;
- Pollution control equipment (spill and leak cleaning kits) must be readily available;

- Ensure personnel training, including: measures to prevent fuel spills, to treat/clean fuel spills, how to react on spill of flammable liquids on clothing and in the inhalation of vapours, leaks simulations; fuel vapour recovery processes, etc. Keep records of all training;
- Maintain the premises and equipment in a clean and tidy state;
- Regularly clean outdoor areas with a broom;
- Wastewater from outside areas must be directed to the contaminated water drainage system, and not enter the storm water system;
- Used oils (waste oil) will be collected, re-used, stored and disposed of in line with disposal procedures for hazardous wastes;
- Ensure the proper management of other hazardous wastes (contaminated soils, used spilling kits, waste lube, etc).

Filling operations

- Isolate the area by cones and a rope;
- Prohibit refuelling operations during tank filling operations;
- Avoiding having people who are not involved in the operation within a 10 metre radius;
- Prohibit smoking and the use of mobile telephones or any other ignition sources during tank filling operations or vehicle refuelling, within a 3 metre radius;
- Use a tight-fill cap to completely seal off the connections between the tubing and the truck's and station's tanks;
- Engines must be turned off during refuelling;
- Prevent overflowing and spilling situations when the storage tanks are being filled (verify filling sensors and be aware of overflow alarms).

Preventing Accidents with fuel mixtures

- Establish a procedure to deal with the potential occurrence of these situations, such as:
- The chemicals and reaction mechanisms associated with the substances mixed or blended must be well understood and documented;
- Chemical and process hazards must be understood and addressed and the facilities should ensure that process equipment, controls, and procedures are designed, installed and maintained to safely operate the process;
- All employees should understand the chemical and process hazards;
- Facilities should establish a system for Standard Operating Procedures and ensure that they are understood and followed;
- Display clear and informative messages for users of the station, as to how to deal with this situation;
- Prepare a procedure to suitably dispose of wastes recovered from the batches of fuel mixture.

Spill Kits

- Emergency spill kits of absorbent material (e.g. sand) must be provided and stored next to the higher risk sites, and must be easily-accessible, ideally outside, in order to allow an immediate response when a spill occurs. This will be clearly labelled and ready for use.
- Drums for the storage of contaminated material must be provided.
- An accurate drawing of the local drainage system shall be posted next to the spill kit.

Closure Phase

- During the closure phase, there may be loss of product into the soil, as a result of a deliberate or accidental release during closure and removal of tanks and tubing. In

addition, this risk may arise outside of the facility site, if the tanks and/or tubing are not properly disposed of.

- In the closure phase, it is important to remove all tanks and pipes. A risk may arise if the tanks are left on site with residual products. As the integrity of the equipment will no longer be ensured or monitored.
- During closure, it must be ensured that facilities do not present a risk to the environment, health or safety. Measures must be taken to ensure that the closure does not result in an unacceptable risk, including:
  - Any and all waste products will be removed from the tanks. Care will be taken to ensure that no product is lost into the soil. Tank closure must be carried out safely, with the removal of explosive vapours, for example by filling the tanks with water or inert gases. All tanks will be safe prior to their removal from the ground. Similar methods will be employed prior to the removal of the pipes.
  - Water used in this process will be contaminated with residual product, and thus a water contamination risk may arise if the contaminated water is not disposed of in a way which is appropriate for hydrocarbon contamination. This would normally imply the removal to a suitable waste handling facility.
  - According to best environmental practices, the tanks, tubing and distributors will be disposed of. However, if the tanks remain in situ, it will be ensured that the procedure is safe. After making the tanks inert and safe, they will be filled in with sand, concrete, inert mud or hydrophobic foam.
  - The tanks and associated tubing which are no longer considered appropriate or safe for fuel storage will not be used for storage of other hydrocarbons, without first ensuring their integrity.
  - The oil/water separators will be removed for disposal, off the facility site. Otherwise they will be filled in a similar way to the tanks. Regardless of the fate of the oil/water separator, all liquid and mud waste will be removed (off the facility site) and all the inlets and outlets will be sealed.
  - Whatever drainage system left behind will be modified to ensure that it does not serve as a path for pollutants to reach groundwater or other waters.
  - If the deactivation is temporary, product can be left in the tanks. In this case, all monitoring procedures will be carried out as if the facility were in operation. If for any reason the monitoring cannot carry on, the tanks will be emptied and made inert.
  - Personnel involved in the closure of a filling and fuel station will be aware and respect obligations with regards to waste disposal, in line with the best practices described above.

Environmental Aspect	Action or Measure
Prevent accidental spills from entering the stormwater drainage system	Provide cleaning equipment conceived specifically to deal with minor spills as may occur at the station. Place a clearly-identified spill kit in a visible location for each fuelling line.
	Develop a step-by-step guide to use of the spill kit.
	Develop an evacuation plan and/or response procedures for emergencies involving large fuel spills.
	Train the whole team in the emergency response procedures. Make sure that all staff knows where the emergency equipment is to be found and is acquainted with its maintenance.
	Label all of the stormwater drains on site in the proximity of the facilities as "Clean Water Only".

Environmental Aspect	Action or Measure
	Inspect the fuel distribution area in order to confirm that rainwater drained or emptied from the roof doesn't enter the areas marked out.
	Check whether the embankment around the fuel distribution area is in good condition and has the capacity to contain a fuel leak in the event of an emergency.
Minimise the risks of environmental contamination and from issues of workers' health and safety	Provide training to the staff regarding the disposal of material contaminated with fuel, such as absorbent material from the spill kit, soaked in fuel.
	Ensure that the product safety cards for all fuels and oils are up-to-date and accessible at all times.
Minimise the risks of fuel leaks as may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the spill containment sumps installed at the tank's discharge nozzle.
	Check if there is fuel, from a possible leak, in the all tanks containment sumps, installed on the manhole to the storage tanks. In the event of suspected leakage, report it immediately.
	Check if there is fuel or lube, from a possible leak in the containment sumps installed under the tanks.
Minimise the risks of fuel leaks as this may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the chambers of the containment sumps installed under the pumps
Minimise the risks of harmful emissions to the atmosphere and the loss of fuel	Check that lids, flanges and connections are closed.
	Confirm that the ventilation conduits are not blocked.
	Supervise the fuel deliveries.
Minimise the risks of water pollution	Carry out an Oil-Water Separator inspection to ensure effective treatment.
Integrity control	Adequate maintenance and calibration of the monitoring equipment

24 DECOMMISSIONING PHASE

Should the WEF be decommissioned a decommissioning plan must be produced. The plan must include details on the decommissioning and dismantling of the WEF, taking in consideration the potential environmental impact associated with it. Environmental monitoring plans must be produced so ensure no pollution occurs during this phase. The plan must include the steps that will be taken to rehabilitate the area after the WEF is dismantled, as well as recycling options of the equipment and structures.

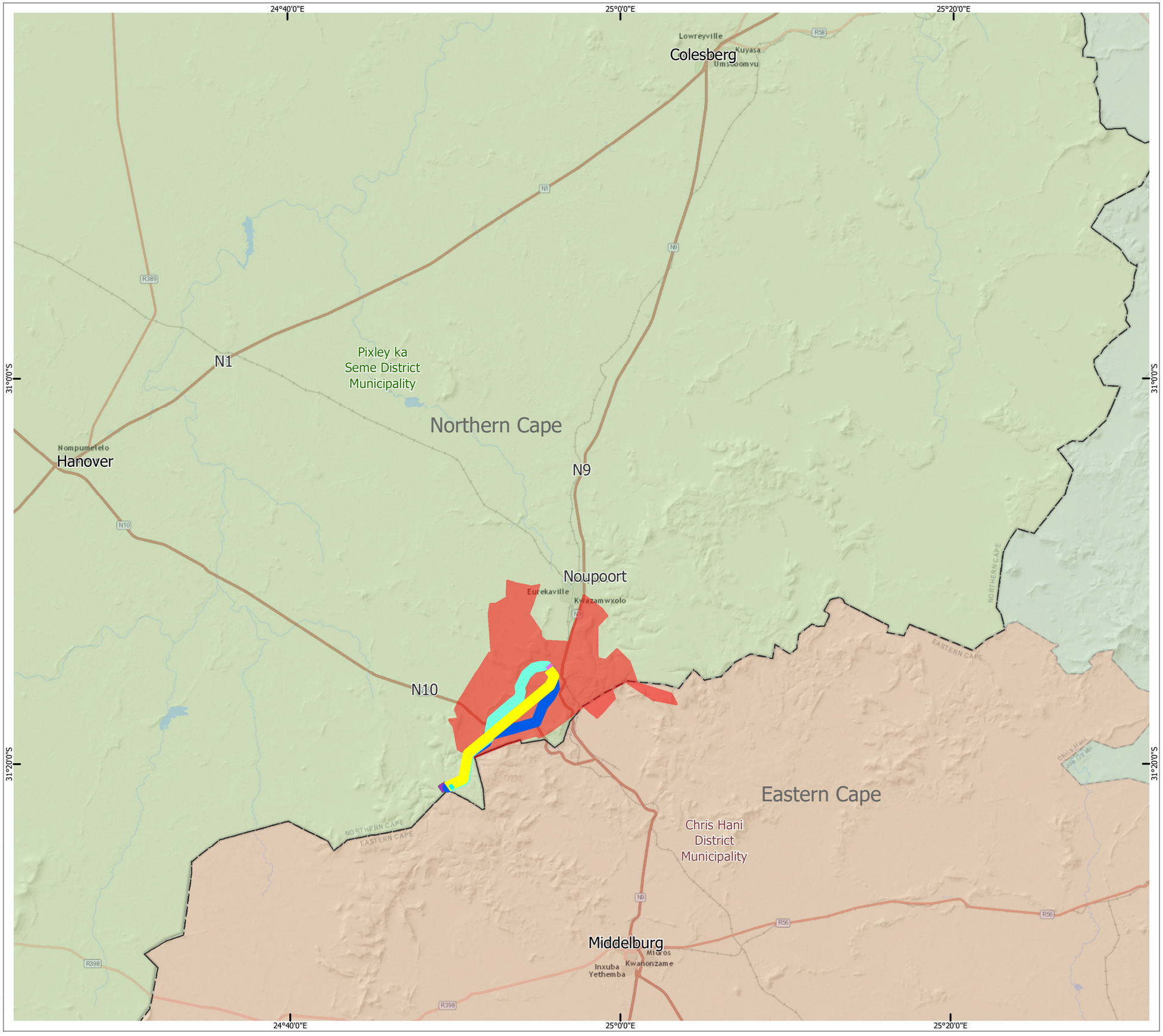
25 CONCLUSION

In terms of the National Environmental Management Act 107 of 1998 everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally acceptable manner.

Furthermore, in terms of the 'Act', the cost to repair any environmental damage shall be borne by the person responsible for the damage.

It is therefore imperative that the management plan is successfully implemented, as a failure to comply could have legal implications.

The environmental impacts on the site will not be significant if the construction management is well implemented, and a set of operational guidelines are developed by the long term site management body.



InnoWind

ARCUS

- Phezukomoya Site Boundary
- Proposed Phezukomoya Substation
- Proposed Umsobomvu 132/400 kV Substation

Grid Corridor Alternatives

- Preferred Alternative
- Alternative 1
- Alternative 2

1:350,000 Scale @ A3

N

0 5 10 km

Produced: AA Reviewed: SC Approved: AB	Ref: 2245/REP/060
	Date: 24/01/2018

Site Location
Figure 1

Phezukomoya Wind Energy Facility Environmental Management Programme Report