VOLUME I: APPENDIX B
ENVIRONMENTAL MANAGEMENT PROGRAMME

for the

PROPOSED UP TO 150 MW PAULPUTS NORTH WIND ENERGY FACILITY, ON-SITE SUBSTATION AND BATTERY ENERGY STORAGE SYSTEM, NORTHERN CAPE PROVINCE

On behalf of

PAULPUTS WIND ENERGY FACILITY NORTH (RF) (PTY) LTD

NOVEMBER 2021

FINAL VERSION

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

240 Main Road
1st Floor Great Westerford
Rondebosch
7700

T +27 (0) 21 412 1529 l E paulputs@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 (EMPr): The EMPr is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMPr contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr 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 EMPr 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 EMPr.

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 EMPr (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 EMPr.

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

Paulputs Wind Energy Facility (Pty) Ltd ('PWEF'), a wholly owned subsidiary of WKN Windcurrent SA (Pty) Ltd, was granted environmental authorisation for the 300 MW (75 Turbine) Paulputs Wind Energy Facility (WEF) and its associated 132 kV grid connection on 11 December 2019 by the Department of Forestry, Fisheries and Environment (DFFE) (DFFE Reference 14/12/16/3/3/2/1120). PWEF are proposing to give permission to Paulputs Wind Energy Facility North (RF) (Pty) Ltd and Paulputs Wind Energy Facility South (Pty) Ltd to split and amend the Environmental Authorisation (EA).

An overview of the total applied amendments for the Paulputs WEF EA, as submitted in the Application to the DFFE, is provided below for contextual purposes:

- Amendment 1: Paulputs South WEF (subject to a separate report and assessment): Paulputs Wind Energy Facility South ('Paulputs South') will consist of a 150 MW facility with up to 35 turbines, with a hub height of up to 180 m, blade length of up to 110 m and a rotor diameter of up to 220 m. All infrastructure is to be located to the east of the N14 Highway (within the authorised development footprint).
- Amendment 2: Paulputs North WEF **(the 'proposed amendment 2')**: Paulputs Wind Energy Facility North (RF) (Pty) Ltd ('Paulputs North') will consist of a 150 MW Facility with up to 40 turbines, with a hub height of up to 180 m, blade length of up to 110 m and a rotor diameter of up to 220 m. The authorised substation will be included within this development and will include a Battery Energy Storage System, which will be housed within the approved temporary laydown area. All infrastructure (turbines, substation, BESS, etc.) will be located to the west of the N14 Highway (within the authorised development footprint).
- Amendment 3: Paulputs North WEF Grid Connection (subject to a separate report and assessment): PWEF is applying for permission to remove (from its EA) and transfer the rights and ownership of the authorised 132 kV Grid Connection (Option C) to Paulputs Wind Energy Facility North (RF) (Pty) Ltd. The approved grid connection will be taken over by Eskom in the future and thus requires a separate Environmental Authorisation. The grid connection description as authorised will not change.

As part of the environmental authorisation (DFFE Reference No. 14/12/16/3/3/2/1120), the Environmental Management Programme (EMPr) was not approved by the Department of Forestry, Fisheries and Environment (DFFE).

This EMPr is prepared as part of the requirements of the EIA Regulations (2014) promulgated under the National Environmental Management Act (Act 107 of 1998), for the Paulputs North WEF, and is an update to the EMPr submitted, including any new mitigation measures that were incorporated in the specialist's assessments.

This document, the environmental management programme (EMPr) must be seen as dynamic, and be updated when and if required, throughout the lifecycle of the project.

The EMPr 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 and operational period of the proposed development.

1.2 Authors of the EMPr

Arcus Consultancy Services South Africa (Pty) Ltd (Arcus) drafted this EMPr as part of the application for the authorised Paulputs WEF (DFFE Ref. 14/12/16/3/3/2/1120) and have now updated the EMPr based on the amendment application. The co-authors of the EMPr are the specialists involved in the assessment of potential impacts identified during the S&EIA and Amendment Application process. The name and role of all authors and co-authors of the amendment application process are included in Table 1.1 below.

Table 1-1: EMPr Amendment Authors and Co-authors

AMENDMENT MANAGEMENT TEAM 2021		
Technical Discipline	Person	Organisation
Project Director and EAP	Ashlin Bodasing	Arcus Consultancy Services SA Pty Ltd
Project EAP	Ashleigh von der Heyden	Arcus Consultancy Services SA Pty Ltd
EAP Assistant	Aneesah Alwie	Arcus Consultancy Services SA Pty Ltd
AMENDMENT SPECIALIST TEAM 2021		
Technical Discipline	Lead Specialist	Specialist Organisation
Avifauna	Dr Owen Davies*	Arcus Consultancy Services SA Pty Ltd
Bats	Jonathan Aronson / Michael Brits	Arcus Consultancy Services SA Pty Ltd
Terrestrial Ecology (Flora and Fauna)	Jamie Pote**	Independent Consultant
Soil, Land Use and Agricultural Potential	Johann Lanz	Independent Consultant
Aquatic / Freshwater	Brian Colloty	Enviro Sci. Pty Ltd
Heritage, Archaeology and Palaeontology	Jayson Orton	ASHA Consulting
Socio-Economic	Leandri Kruger	Independent Consultant
Noise	Alan Moore	Arcus Consultancy Ltd
Visual	Kerry Schwartz	SiVest
Traffic and Transportation	Stephen Fautley	Techso (Pty) Ltd

** Dr Owen Davies has replaced Andrew Pearson and undertook an additional site visit in February 2020 to verify the information contained in the approved Paulputs WEF Avifaunal specialist report.*

*** Jamie Pote replaced Simon Todd and undertook an additional site visit in June 2021 to verify the information contained in the approved Paulputs WEF Terrestrial Ecology specialist report.*

1.3 Project Developer

The Project Developer - Paulputs Wind Energy Facility North (RF) (Pty) Ltd - is the 'owner' of the project and as such is responsible for ensuring that the conditions of the Environmental Authorisation issued by DFFE in terms of NEMA (should the project receive

such authorisation) are fully satisfied, as well as ensuring that any other necessary permits or licences are obtained and complied with. It is expected that the Project Developer will appoint the Construction Manager and the Operations Manager.

1.4 Purpose and Aims of this Document

An Environmental Management Programme (EMPr) is defined as "an *environmental management tool used to ensure that undue or reasonably avoidable adverse impact of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the project are enhanced."*

This EMPr outlines measures to be implemented in order to minimise adverse environmental degradation and enhance positive impacts associated with the wind energy facility. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction and operational periods. The purpose of the EMPr is to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
  - Minimise disturbance of the natural environment;
  - Prevent pollution of land, air and water;
  - Protect indigenous flora and fauna; and
  - Prevent soil erosion and facilitate re-vegetation;
- Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
- Adopt the best practicable means available to prevent or minimise adverse environmental impacts;
- Identify and mitigate against any potential impact on ecology;
- Describe all monitoring procedures required to identify impacts on the environment; and
- Train employees and contractors with regard to environmental obligations.

All management plans and mitigation measures should be adaptive and amended as required based on audits of their effectiveness.

2 THE PROPOSED PAULPUTS AMENDMENT – 150 MW PAULPUTS NORTH WEF

Paulputs Wind Energy Facility North (RF) (Pty) Ltd ('Paulputs North') will consist of a 150 MW Facility with up to 40 turbines, with a hub height of up to 180 m, blade length of up to 110 m and a rotor diameter of up to 220 m. The authorised substation will be included within this development and will include a Battery Energy Storage System, which will be housed within the approved temporary laydown area. All infrastructure (turbines, substation, BESS, etc.) will be located to the west of the N14 Highway (within the authorised development footprint).

The authorised Paulputs WEF, grid connection and substation is located approximately 35 km north-east of Pofadder and approximately 85 km north-west of Kakamas in the Northern Cape Province. The authorised Paulputs WEF is situated in two district municipalities, the Namakwa District Municipality and the ZF Mgcawu District Municipality, and within the Khâi-Ma Local Municipality and the Kai !Garib Local Municipality.

Specialists assessed the proposed amendments and provided statements / reports to advise if the amendment will create any significant changes to the impact on the environment.

The proposed location of turbines seeking approval from the DFFE are presented in Figure 1. These locations have been identified based on specialist constraints and sensitivity mapping conducted the original EIA process. All buffers recommended in the original EIA for the Paulputs WEF (Arcus, 2019) have been taken into account (Figure 2).

If awarded Preferred Bidder Status, Paulputs Wind Energy Facility North (RF) (Pty) (Ltd) would enter into an implementation agreement with the Department of Energy (DoE) and a Power Purchase Agreement (PPA) with the buyer of the energy, which is in the majority of cases Eskom. Once operational the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distribute the energy through the national grid to the energy users.

2.1 Construction Phase

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 amendment process. The final design may include infrastructure which is of equal or less than dimensions to those stated below but not more than.

2.1.1 Turbines

The proposed Paulputs North WEF will comprise of up to 40 turbines with a maximum generation capacity of 150 MW. Approximately 45 km of internal roads will connect the turbines. Onsite cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground, where technically feasible. Turbines will have a maximum height to blade tip of 290 m (a hub height of up to 180 m, and a blade length of up to 110 m).

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.

The turbine rotor speed will vary according to the energy available in the wind, and 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. At 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.

Turbines will be placed on steel and concrete foundations. The overall hardstanding area including foundation, crane pad, and temporary and permanent laydown area for each turbine will be approximately 0.8 hectares. The overall hardstanding construction footprint is estimated to a total of 32 hectares for a maximum of up to 40 wind turbines (0.8 ha x 40 turbines = 32 ha).

Once construction is complete, some of the hardstanding and laydown area can be rehabilitated.

2.1.2 Laydown Areas, Electrical Cabling and Onsite Substation

It is assumed that the permanent laydown area and the temporary construction laydown will form part of the 200 x 200 m substation compound. A Battery Energy Storage System is to be located within the area earmarked for temporary construction yard. The substation compound is 4 hectare to allow for a 1.1 hectare on-substation, 0.5 hectare office block, 1 hectare permanent laydown and 1 ha hectare temporary laydown.

The electricity from the turbines will be transferred via a 33 kV electrical network to a 33/ 132 kV onsite substation. Where feasible and possible this will be underground cabling. The onsite substation will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid.

2.1.3 Access

The turbine locations will be accessed through a network of unsealed tracks which will be established across the project site. These access tracks will be up to 12 m wide during construction, depending on local topography, but will be reduced to between 4 m and 6 m during operation. Such roads are required to facilitate access for the cranes and abnormal load deliveries of turbine components.

Existing farm access tracks will be upgraded and utilised where possible, as will existing watercourse crossings.

2.1.4 Compound

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

2.1.5 Ancillary Equipment

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

- Anemometer masts;
- Security fencing; and
- CCTV monitoring towers.

2.1.6 Battery Energy Storage Facility

The Preferred battery technology being considered is Lithium Ion (Li-Ion) Battery Energy Storage.

Alternative technologies which may be considered by the Applicant include Flow, Solid-State, and/or Sodium Sulphur batteries.

Typically, a BESS consist of multiple battery cells that are assembled together to form modules. Each cell contains a positive electrode, a negative electrode and an electrolyte. A module may consist of thousands of cells working in conjunction. Modules are normally packaged inside containers (similar to shipping containers) and these containers are delivered pre-assembled to the WEF site (Plate 2-1 shows the inside of one such container).

The applicant anticipates the placement of containers within the area currently authorised for temporary laydown. Ancillary (or associated) infrastructure will include (but not limited to):

- a battery room;
- inverters;
- switch gear room; and
- Supervisory Control and Data Acquisition (SCADA) equipment.

The containers will have approximate dimension ranges of: height 2 m - 5 m, width 1.5 m - 3 m, length 7 m - 20 m. The containers are raised slightly off the ground and are bunded to prevent possible environmental damage resulting from any equipment malfunction. The proposed development is considering the option of stacking these containers vertically to a maximum of two container layers or a height of 10 m.

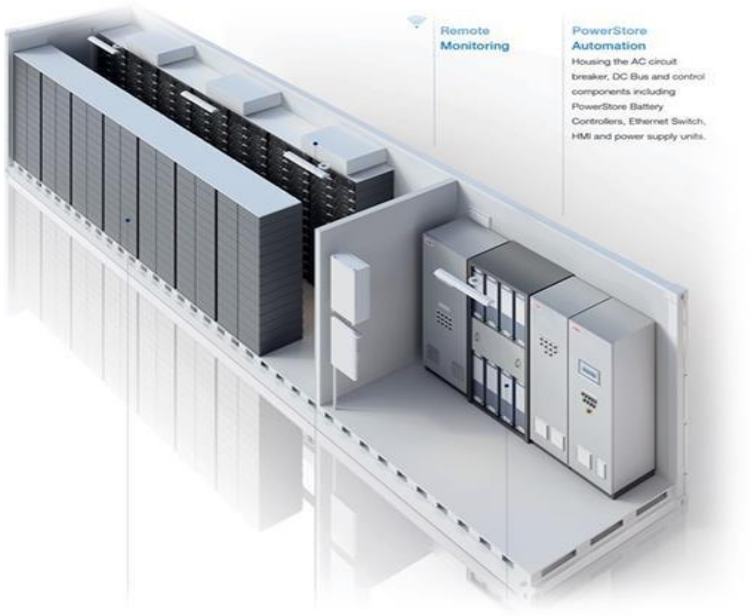


Plate 2-1: Typical representation of how batteries and battery modules are housed and assembled.

Preferred Technology - Lithium ion (Li-ion) batteries are the most common stationary battery in the market today. Simply put, the batteries consist of a graphite electrode and a lithium-based electrode immersed in a liquid. When the battery is in use, charged lithium atoms ions flow from the graphite electrode to the lithium-based electrode through the liquid, and that flow of charged particles is what generates electricity. When the battery is recharged the flow is reversed, sending the lithium ions back to the graphite anode where they are stored ready for discharge.

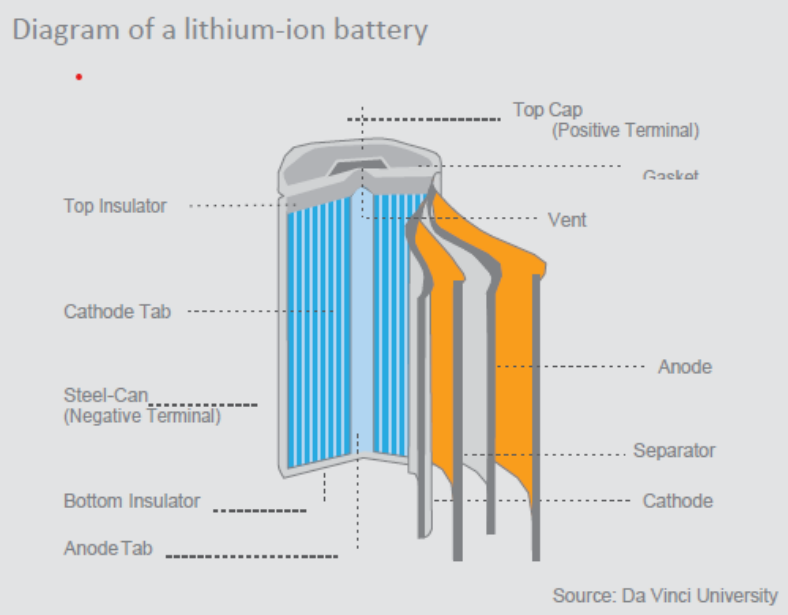


Plate 2-2: Diagram of a Lithium-Ion Battery

No hazardous substances are expected to occur or be stored on site for the Paulputs North WEF, and no additional listing notice activities are triggered by the placement and operation of the BESS.

Plate 2-3 provide a visual representation of a typical set up of an on-site substation and BESS. Paulputs North WEF will have similar project components and will be designed in a similar manner.

Plate 2-3: A stock image of a similar development with an on-site substation and BESS. Source [https://reneweconomy.com.au/why-grid-based-battery-storage-is-already-a-no-brainer-in-australia-85967/]

3 LEGAL FRAMEWORK

A Part II Amendment Application for Environmental Authorisation, in terms of the National Environmental Management Act, Act 107, 1998 (NEMA), Environmental Impact Assessment Regulations, 2014, as amended has been submitted to the Department of Forestry, Fisheries and Environment.

The listing notice activities as applied for in the original Paulputs WEF EA remain unchanged for this part II amendment application. Table 3.1 below highlights the listed activities that have been approved as part of the Paulputs WEF EA (DFFE Ref. 14/12/16/3/3/2/1120).

Table 3-1: Activities Approved for the 300 MW Paulputs Wind Energy Facility

Listing Notices 1 - 3	*Listed Activity*	Description of project activity that triggers listed activity
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.*	Electrical reticulation will be installed to transfer electricity from the turbines to an onsite substation. Cables will be installed underground where feasible. These internal transmission lines are expected to be of 33 kV capacity. 132 kV overhead powerlines will be installed to transfer electricity from the onsite substation to the existing Eskom substation.
Listing Notice 1 GN R 327 Activity 12	*The development of-* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse (c) if no development setback exists within 32 m of a watercourse, measured from the edge of a watercourse*	Infrastructure such as roads is proposed within 32 m of a watercourse. The cumulative footprint of all proposed development within 32 m of a watercourse may exceed 100 square metres.
Listing Notice 1 GN R 327 Activity 14	*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*	Construction of the proposed development will require dangerous goods in the form of hydrocarbon fuels (e.g. diesel), paints and solvents, oils and greases. Sewage and waste streams will be generated by the WEF. During construction of the WEF in particular the combined capacity of dangerous goods on site may exceed 80 cubic metres. The proposed onsite substation is likely to require the use of transformer oils/other hazardous substances during the operational phase.
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 overhead powerline could 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.
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;*	Internal access roads of 12 m will be required between turbines.
Listing Notice 1 GN R 327 Activity 28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.*	Construction of the proposed development will change the land use from agriculture to mixed - agriculture and electricity generation and transmission. The proposed development is outside an urban area and has a footprint that will exceed 1 ha.
Listing Notice 1 GN R 327 Activity 48	*The expansion of-* *Infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such*	Existing infrastructure such as roads and bridges within 32 m of a watercourse may require expansion. The cumulative footprint of all proposed development expansion within 32 m of a watercourse may exceed 100 square metres.

Listing Notices 1 - 3	*Listed Activity*	Description of project activity that triggers listed activity
	expansion occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse	
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;*	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 m 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 WEF will consist of a number of wind turbines for electricity generation with a combined capacity of more than 20 MW.
Listing Notice 2 GN R 325 Activity 15	*The clearance of an area of 20 hectares or more of indigenous vegetation.*	The construction of the proposed development will require the clearance of more than 20 hectares of indigenous 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* *(ii) Outside urban 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 part of it falls within a CBA 1.
Listing Notice 3 GN R 324 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* *(ii) 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. Parts of the site fall within CBA 1.
Listing Notice 3 GN R 324 Activity 14	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a*	Bridges and infrastructure may be constructed within 32 m of watercourse(s). The site lies outside of an urban area and a portion of the site falls within a CBA 1.

Listing Notices 1 - 3	*Listed Activity*	Description of project activity that triggers listed activity
	watercourse, measured from the edge of a watercourse; *(g) Northern Cape* *(ii) Outside urban areas:* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	
Listing Notice 3 GN R 324 Activity 18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *(g) Northern Cape* *(ii) Outside urban areas* *(ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Existing farm roads may need to be widened or lengthened. The site lies outside of an urban area and a portion of the site falls within a CBA 1.
Listing Notice 3 GN R 324 Activity 23	*The expansion of—* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *(g) Northern Cape* *(ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	The construction of the WEF may include the expansion of existing bridges over watercourses. The site lies outside of an urban area and a portion of the site falls within a CBA 1.

3.1 Legislative Requirement for Scope and Content of the EMPr

Table 3-2: Legislative Requirements for Scope of Assessment and Content of Environmental Management Programme

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		Location in EMPr
	Content of environmental management programme (EMPr)	Section 1.2 Appendix A
1	*(1) An EMPr must comply with section 24N of the Act and include-*	
(a)	*details of-* *(i) the EAP who prepared the EMPr; and* *(ii) the expertise of the EAP to prepare an EMPr, including a curriculum vitae;*	
(b)	*A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;*	Section 2
(c)	*a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitives of the preferred site, indicating any areas that should be avoided, including buffers;*	Figure 2
(d)	*a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment processed for all phased of the development including-* *(i) planning and design;* *(ii) pre-construction activities;* *(iii) construction activities;* *(iv) rehabilitation of the environment after construction and where applicable post closure; and* *(v) where relevant, operation activities;*	Sections 4 - 22
(f)	*a description of proposed impact management actions, identifying the manner in which the impact management outcomes and contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to-* *(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*	Sections 4 - 22
	(ii) comply with any prescribed environmental management standards or practices;	Sections 4 - 22
	(iii) comply with any applicable provisions of the Act regarding closure, whre applicable; and	Sections 4 - 22
	(iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Sections 4 - 22
(g)	*the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Sections 4 - 22
(h)	*the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Sections 4 - 22
(i)	*an indication of the persons who will be responsible for the implementation of the impact management actions;*	Sections 4 - 22
(j)	*the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;*	Sections 4 - 22
(k)	*the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);*	Sections 4 - 22

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		Location in EMPr
(l)	*a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;*	Sections 4 - 22
(m)	*an environmental awareness plan describing the manner in which-* *(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and* *(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and*	Section 4
(n)	*any specific information that be required by the competent authority.*	Specific information required by the competent authority during the amendment process has been included throughout the EMPr.

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, 1998 (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 below.

Developer Representative – Environmental Manager

- Review and approve EMPr prior to authorisation by DFFE.
- 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.

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, DFFE and Northern 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 EMPr during the construction and operations phases, and for monitoring, reviewing and verifying compliance of the contractor with the EMPr, record-keeping and updating of the EMPr as and when necessary.

The ECO will:

- Be fully knowledgeable with the contents of the EMPr;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMPr are communicated to the contractor, all site staff, the contractor and /or site manager are made aware of the contents of the EMPr, through presentations and discussions;
- Ensure that compliance to the EMPr 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 EMPr, 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 EMPr for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMPr;
- Update the EMPr 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 EMPr 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 EMPr 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 EMPr 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 EMPr. They shall know and understand the specifications of the EMPr and be able to assist other staff members in matters relating to the EMPr.

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, and

- 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 EMPr.

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 EMPR may be justified as failure to comply with instruction from the highest authority.

4.6 Dealing with Non-Compliance with the EMPR

There may be difficulties encountered with carrying out the mitigation measures within the EMPr, this may result in non-compliance with the EMPr. It may be possible that the contractor and or the developer put 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 EMPr Amendments and Instructions

No EMPr amendments shall be allowed without the approval of the DFFE. Amendments may be possible, following discussions with the relevant ECO or environmental consultant, who may propose EMPr amendments on behalf of the developer or issue EMPr instructions, corrective actions, remediation or rehabilitation. These correction actions 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.
- To ensure the DFFE has an amended EMPr to approve based on micro-siting and specialist input. The EMPr must contain the final site layout for approval.

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 must 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 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 must 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 DFFE for approval.

5.1 Final Site Assessment by Specialists

Prior to the submission of the final layout plan to the DFFE for approval, the following specialists must visit the site to assist with micro-siting the layout:

- Flora and fauna specialists;
- Bat specialist;
- Avifaunal specialist;
- Aquatic specialist; and
- Archaeologist.

Following the selection of turbine to be used for the project, the developer must update the layout plan / site development plan, this together with the following management plans, to be developed and / or updated, must be submitted to the DFFE for approval:

- *Aloidendron dichotomum* Monitoring Plan – this plan will include measures to ensure the sustainability of the population of *Aloidendron dichotomum* during the lifecycle of the proposed development. It must include a population analysis prior to the commencement of construction provide measure to protect this species.
- Traffic / Transport 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.
- Heritage chance-find procedure.

The construction of the WEF will result in water crossings for the expansion of existing and / the construction of new bridges over water courses. The developer must ensure that Water Use Licences are applied for and approved, prior to the start of construction. All

mitigation measures proposed in the water use licence must be adhered to and included in an updated EMPr and submitted to the DFFE for approval.

Should any telephone communication lines require moving this will have to be facilitated and approved by Telkom or any other relevant service provider.

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:

- 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.
- Placement of BESS on area earmarked as Temporary Storage.

5.2 Method Statements

The Contractor shall provide Method Statements for approval by the ECO and the Engineer prior to work commencing on aspects of the project deemed or identified to be of greater risk to the environment and/or which may not be covered in sufficient detail in the construction phase of the EMPr, when called upon to do so by the Engineer or ECO.

A Method Statement is a "live document" in that modifications are negotiated between the Contractor and the ECO/project management team, as circumstances unfold. All Method Statements will form part of the construction phase of the EMPr documentation and are subject to all terms and conditions contained within the construction phase of the EMPr.

Note that a Method Statement is a 'starting point' for understanding the nature of the intended actions to be carried out and allows for all parties to review and understand the procedures to be followed in order to minimise risk of harm to the environment.

Changes to, and adaptations of Method Statements can be implemented with the prior consent of all parties.

A Method Statement describes the scope of the intended work in a step-by-step description in order for the ECO and the Engineer to understand the Contractors intentions. This will enable them to assist in devising any mitigation measures, which would minimize environmental impact during these tasks.

For each instance where it is requested that the Contractor submit a Method Statement to the satisfaction of the Engineer and ECO, the format must clearly indicate the following:

- What - a brief description of the work to be undertaken;
- How - a detailed description of the process of work, methods and materials;
- Where - a description/sketch map of the locality of work (if applicable);
- When - the sequencing of actions with due commencement dates and completion date estimates;
- Who – The person responsible for undertaking the works described in the Method Statement; and
- Why – a description of why the activity is required.

All Method Statements are to be to the satisfaction of the ECO, Engineer and, where practical and deemed necessary, should be endorsed as being acceptable by the environmental representative of the Relevant Authority.

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; and
- Hazardous materials management.

5.3 Permit Requirements

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the Environmental Authorisation. Paulputs Wind Energy Facility North (RF) (Pty) Ltd is responsible for ensuring that they hold the necessary permits in order to comply with national and local regulations. Additional permit requirements are described below.

5.3.1 Borrow Pits

A borrow pit refers to an open pit where material (soil, sand or gravel rock) is removed for use at another location. Paulputs Wind Energy Facility North (RF) (Pty) Ltd or their contractors may want to use borrow pits for certain earthworks operations, such as the construction of roads, embankments, bunds, berms, and other structures.

The establishment of borrow pits is regarded as a mining activity and is legislated in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA). A mining permit must be obtained from the Department of Minerals and Energy prior to the establishment of borrow pits on the site.

5.3.2 Water Use License

There are licensing procedures that need to be followed for particular "water uses". Water uses that may be of relevance to the development and associated road construction include the following:

- Taking of water from a water resource, including a water course, surface water, estuary or aquifer (i.e. borehole);
- Altering the bed, banks, course or characteristics of a water course; and/or
- Impeding or diverting of a flow in a water course.

Under the National Water Act, 1998 (Act No. 36 of 1998), either General Authorisation or a Water Use Licence must be applied for.

5.3.3 Heritage

Should any archaeological or palaeontological site or any meteorite be found during construction the South Africa Heritage Resource Agency must be contacted. No archaeological or palaeontological site or any meteorite site may be destroyed or moved without a permit.

- A report detailing the results of the recommended walkdowns of the final layouts of the WEF must be compiled by a qualified archaeologist and submitted to SAHRA for comment once completed.
- If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.
- If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule.
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule.

5.3.4 Vegetation Search and Rescue

Under the Forests Act, 1998 (Act No. 84 of 1998) (NFA), a license must be applied for from the Department of Agriculture, Land Reform & Rural Development (DALRRD) for the removal or disturbance of any protected trees on the site, in terms of the List of Protected Tree Species promulgated under the NFA.

Permits are needed for any damage/removal/movement/transport of specially protected [(Regulation 49(1) (a) and (d)] and protected species [(Regulation 50 (1) (a) and (d)] in terms of the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCA). Permits are also needed for instances where indigenous plant species are impacted up to 100 m from middle of the roads and rivers [(Regulation 51 (1)] or for large scale clearing [(Regulation 51 (2)] in terms of the NCA.

5.4 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.

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.);

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

- 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 rehabilitated upon completion of the construction period, providing measures to be used for rehabilitation.
- 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.
- 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.

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 must be secure so as to minimize the risk of crime. They must also be safe from access by children / animals etc.
- Avoid the placement of batteries near watercourses and sensitive features
- Including automatic fire detection systems in the development design;
- Including automatic fire suppression systems in the development design;
- Including redundancy in the design of the BESS to provide multiple layers of protection;
- Designing the BESS and substation yard to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS.
- 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 must include a bund wall high enough to contain at least 110% of any stored volume, and this must be sited away from drainage lines on 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 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 must 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 must 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.
- The applicant must compile and implement the following additional programs to be submitted to the Competent Authority prior to the commencement of installation of the BESS:
    - Tactical Fire Response Plan;
    - Lifecycle Battery Recycling programme; and
    - First Responder Training manual

5.4.1 Site Clearance

Vegetation clearance must preferably be phased as required to work in certain areas, rather than clearing of the entire site initially. If this is not practical and the entire site is cleared at the start of the contract, it is to be stabilized immediately to control dust. Wherever possible, vegetation shall be trimmed rather than cleared.

Cleared vegetative material is not to be dumped anywhere other than an approved waste disposal site or an area as agreed to with the ECO.

Wherever possible and where the material is suitable, the material must be chipped for later use as mulch in landscaped areas or for stabilization purposes or it must be dumped at a green waste recycling depot for compost production.

Invasive alien plant species, which are removed from the site, are not to be chipped for mulch if they are in a seed bearing state. Such material is to be disposed of at a suitable waste disposal site. Wherever possible, suitable larger stumps must be made available to the local community as firewood.

Plant material removed from the site is not to be burnt for disposal on site unless a burning permit has been obtained from the local authority.

Sensitive ecosystems in the vicinity of the areas of construction must be demarcated (e.g. using danger tape or droppers) prior to any construction activities, so that these can be avoided.

Removal of vegetation must be kept to a minimum, and cleared areas must be re-vegetated after clean-up. A detailed planting plan must be developed, in consultation with a landscaper and ecologist.

Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development

Demarcate all areas to be cleared with construction tape or similar material. However, caution must be exercised to avoid using material that might entangle fauna.

An alien control and monitoring program must be developed to ensure that the site is cleared of alien plants (as listed under the Conservation of Agricultural Resources Act 43 of 1983 - as amended/updated) and kept free from alien plants for the duration of the construction phase.

A low cover of vegetation must be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

5.4.2 Topsoil

Topsoil / top material shall be removed from all areas cleared of vegetation and retained for future landscaping use, where feasible. Top material must exclude litter, building rubble, alien plant material or any other waste.

All topsoil, and specifically any topsoil from areas which are likely to contain bulbs, must be stripped and stockpiled for re-use in rehabilitation. This will constitute at least a 300mm layer.

Topsoil shall be stored in areas demarcated by the ECO and Engineer and in piles not higher than 2 m, and may not be removed from site, or used for any purpose other than in the rehabilitation of the site post-construction. The stockpiles shall not be compacted or disturbed, and shall be domed at the top to promote runoff. The period between the stockpiling of topsoil and its utilization shall be as short as possible, and ideally the topsoil must be transferred to its intended site of use immediately following site clearance and stockpiling. This would also avoid double handling.

Stockpiles that are to be stored for less than three months must be covered with shade-cloth or Geotech fabrics or similarly suitable material to prevent erosion. If stockpiles are to be stored for more than 3 months a protective vegetation layer must be established to cover topsoil stockpiles in order to protect them against erosion and desiccation. If possible, the stockpile must be kept moist in order to maintain the vitality of the vegetation. Vegetation may not consist of weeds, but must comprise of grass or ground covers.

5.5 Design Phase Mitigation Measures

Table 5-1: Preconstruction / Design Phase Mitigation Measures

Mitigation Measure	Responsibility	Timing / Frequency
Impacts on Vegetation and Listed or Protected Plant Species Resulting from Construction Activities		
Preconstruction walk-through of the approved development footprint by a qualified specialist to ensure that sensitive habitats and species are avoided where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction. Monthly thereafter.
Search and Rescue of species of conservation concern (SCCs) must be conducted prior to clearing activities.	ECO to monitor Site engineer/site manager	Preconstruction.
Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.	ECO to monitor Site engineer/site manager	Pre-construction. Monthly thereafter.
Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.	ECO to monitor Site engineer/site manager	During site establishment. Monthly thereafter.
ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.	ECO to monitor Site engineer/site manager	Pre-construction. Monthly thereafter.
Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.	ECO to monitor Site engineer/site manager	Pre –construction. During site establishment Monthly thereafter.
Temporary lay-down areas must be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas must be rehabilitated after use.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Ensure that lay-down and other temporary infrastructure is within low- sensitivity areas.	ECO to monitor Site engineer/site manager	Design Phase During site establishment
Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment and post construction
The exact routing of the roads must be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-through of the facility.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.

Mitigation Measure	Responsibility	Timing / Frequency
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	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.
Wherever excavation is necessary, topsoil must be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. The recovery of the indigenous shrub/grass layer must be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 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. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as these are also likely to be prone to invasion problems. Regular alien clearing must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Alien Plant Invasion Risk		
An alien plant management plan must be submitted as part of the EMPr to be approved by the DFFE and implemented on site.	ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.
Regular alien clearing must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increased Erosion Risk and Soil Degradation		
Dust suppression and erosion management must be an integrated component of the construction approach.	ECO to monitor Site engineer/site manager	Weekly
Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.	ECO to monitor Site engineer/site manager	Monthly
A low cover of vegetation must be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Timing / Frequency
Disturbance near to drainage lines or the pan must be avoided and sensitive drainage areas near to the construction activities must be demarcated as no-go areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.
Direct Faunal Impacts		
All personnel must 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 persecuted out of superstition.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction walk-through of the facility to identify areas of faunal sensitivity such as occupied burrows	Developer ECO to monitor Site manager	Pre- construction.
Any fauna threatened by the construction activities must be removed to safety by the ECO or appropriately qualified environmental officer.	ECO to monitor Site engineer/site manager	During site establishment Weekly.
The illegal collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. Personnel must not be allowed to wander off the construction site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.
If any parts of site such as construction camps must be lit at night, this must be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which must be directed downwards	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No unauthorized persons must be allowed onto the site and site access must be strictly controlled.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
All construction vehicles must adhere to a low speed limit (40km/h for cars and 30km/h for trucks). Speed limits must apply within the facility as well as on the public gravel access roads to the site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up in the appropriate manner as related to the nature of the spill.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Loss of Rare, Endemic or Protected Species		
A final pre-construction walkdown must be conducted, as part of a Plant Search and Rescue plan, with the appropriate permits in place.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Where any roads and crossings will be upgraded, the following applies: 1. All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised. 2. River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase. 3. Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion. Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. During site establishment. Monthly thereafter.
Loss of Functional Habitat within the Site and Near Any of the Required Crossing Upgrades		
All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. Monthly thereafter.
Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor	Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
	Site engineer/site manager	
Avifaunal Habitat Destruction		
High traffic areas and buildings such as offices, batching plants, storage areas etc. must be situated in areas that are already disturbed, if available.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Existing roads and farm tracks must be used where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
The minimum footprint area possible of infrastructure must be used, including road widths and lengths.	ECO to monitor Site engineer/site manager	Prior to construction
During construction laydown areas and temporary access roads must be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off road driving.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Highly sensitive zones and no-go areas (e.g. nesting areas) must be cordoned off, clearly marked and avoided unless absolutely necessary.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Prior to construction, the avifaunal specialist must conduct a site walkthrough, covering the final internal and access road and internal power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities need to be excluded and/or the schedules adjusted.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All contractors are to adhere to the EMPr and must apply good environmental practice during construction.	ECO to monitor Site engineer/site manager	Throughout construction
Turbines must not be constructed within any High Sensitivity Zones	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction
Disruption of Local Bird Movement Patterns		
Turbines must not be constructed within any high sensitivity zones identified through pre-construction monitoring and impact assessment.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction

Mitigation Measure	Responsibility	Timing / Frequency
The lowest feasible number of turbines should be constructed for the required MW output. Therefore, fewer larger (i.e with a higher MW output) turbine models should be favoured where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction
Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species, if acceptable to the Civil Aviation Authority.		
Avifaunal Disturbance and Displacement		
Prior to construction, the avifaunal specialist must conduct a site walkthrough, covering the final internal and access and internal power line routes as well as the final turbine positions, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results must inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	ECO to monitor Site engineer/site manager	Monthly and when required.
During Construction, if any of the Priority Species or Red Data species identified in the avifaunal report are observed to be roosting and/or breeding in the vicinity the Avifaunal Specialist is to be contacted immediately for further instruction, while a 'no go' buffer is to be instituted around the nest site until the specialist has given further instructions. The impact assessment identified aquatic features as being high avifaunal sensitivity features and a 200 m buffer is therefore advised. Suitable buffers have been recommended as read below: Verreaux's Eagle (3 km); Pale Chanting Goshawk (500 m); and Greater Kestrel Nest (500 m)	ECO to monitor Site engineer/site manager	Pre-construction, post final design
No nests are to be disturbed or moved.	ECO to monitor Site engineer/site manager	As per specialist requirements.
Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be clearly marked, cordoned off and avoided unless absolutely necessary.	Developer / Site Engineer ECO to monitor Site engineer/site manager	As per specialist requirements.
Bird collisions		
Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species, if acceptable to the Civil Aviation Authority.	Developer / Operator to implement. ECO to Monitor.	Pre-Construction Design Phase.

Mitigation Measure	Responsibility	Timing / Frequency
Place new internal power lines on the WEF underground where possible and technically feasible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-Construction Design Phase.
Electrical infrastructure is not to be constructed in 'no-go' areas	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-Construction Design Phase.
Bat Roost Disturbance and/or Destruction		
Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and must be the primary mitigation measure. Low lying areas, buildings, woodland/thicket and areas near water must be avoided.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
It is recommended that a bat specialist survey the confirmed turbine locations and all other proposed site infrastructure for the presence of roosts within 200 m before any construction activities commence and once the preliminary design and layout of each WEF is complete.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
It is recommended that a bat specialist surveys the confirmed turbine locations and the locations of all other site infrastructure, such as pylons, for the presence of occupied roosts among the potential roosts before any construction activities commence and once the preliminary design and layout of the site is complete.	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.
If occupied roosts are confirmed these must be buffered based on best practise guidance, which includes a minimum buffer of 200 m.	Developer ECO	Pre-construction / design phase.
Clearing of natural and agricultural areas be kept to a minimum.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Dust suppression measures to be used during the full construction phase.	ECO to monitor Site engineer/site manager	Weekly
Any new roosts discovered, must be reported and incorporated into the adaptive management plan.	ECO to monitor Site engineer/site manager	Monthly and as required during construction
Bat Habitat Modification		
Clearing of natural and agricultural areas be kept to a minimum.	ECO to monitor	Pre-construction / design phase.

Mitigation Measure	Responsibility	Timing / Frequency
	Site engineer/site manager	Monthly thereafter.
Before construction commences, a bat specialist must conduct a site walkthrough, covering the final road routes as well as the final turbine positions.	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.
During construction laydown areas and temporary access roads must be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off-road driving	ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and a habitat restoration plan must be developed by a specialist	ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Where lights need to be used such as at the substation and switching station and elsewhere, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights (Rydell 1992; Stone 2012). High pressure sodium and white mercury lighting is attractive to insects (Blake et al. 1994; Rydell 1992; Svensson & Rydell 1998) and should not be used as far as possible	Site engineer/ site manager Developer to implement ECO	Monthly thereafter.
Bats must be prevented from entering any possible artificial roost structures (e.g. roofs of buildings, road culverts and wind turbines) by ensuring that they are sealed in such a way as to prevent bats from entering. If bats colonise WEF infrastructure, a suitably qualified bat specialist must be consulted before any work is undertaken on that infrastructure or attempting to remove bats. Ongoing maintenance and inspections of buildings must be carried out to ensure no access to bats or actively roosting bats.	Site engineer/ site manager. Developer to implement. Specialist to be appointed. ECO to monitor.	Pre-construction / design phase.
Increasing the spacing between lights, and the height of light units can reduce the intensity and volume of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between and over lights.	Site engineer/ site manager Developer to implement ECO	Monthly thereafter.
Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane should be restricted and directed to minimise light trespass and sky glow.	Site engineer/ site manager Developer to implement ECO	Pre-construction / design phase.
The height of the lower blade swept area must be maximised.	Site engineer/ site manager Developer to implement	Pre-construction / design phase.
Loss of Riparian Systems and Disturbance of the Alluvial Watercourses		
Where new 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	ECO to monitor	During site establishment

Mitigation Measure	Responsibility	Timing / Frequency
(erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible).	Site engineer/site manager	Monthly thereafter.
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas within aquatic environment, using selected species detailed in this report	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on Riparian Systems through the Possible Increase in Surface Water Runoff from Hard Surfaces and or Roads on Riparian Form and Function		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas or have steep embankments.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increase in Sedimentation and Erosion within the Development Footprint		
Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities. Any management actions must be dealt with in the Stormwater Management Plan (SWMP) typically submitted post EA, forming part of any WULA.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on Localized Surface Water Quality		
Containment of all contaminated water by means of careful run-off management on the development site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Timing / Frequency
Working protocols incorporating pollution control measures (including approved method statements by the contractor) must be clearly set out in the EMPR for the project and strictly enforced.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Appropriate ablution facilities must be provided for construction workers during construction and on-site staff during the operation of the facility (generally accepted 1:14 separate male and female facilities).	ECO to monitor Site engineer/site manager	Pre-construction. During site establishment. Weekly
Potential Visual Effect of Construction Activities, including Cranes, Construction Traffic, Dust and Noise Affecting the Rural Sense of Place		
Carefully plan to mimimise the construction period and avoid construction delays	Site engineer/site manager	Design phase
Inform receptors of the construction programme and schedules	ECO to monitor Site engineer/site manager	Design phase
Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing should take place in a phased manner.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Maintain a neat construction site by removing rubble and waste materials regularly.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Make use of existing gravel access roads where possible	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Limit the number of vehicles and trucks travelling to and from the proposed site, where possible	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Unless there are water shortages, ensure that dust suppression techniques are implemented – on all access roads; – in all areas where vegetation clearing has taken place; – on all soil stockpiles.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Visual Mitigation During Construction		
Access and haul roads to use existing farm tracks as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Weekly

Mitigation Measure	Responsibility	Timing / Frequency
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Measures to control wastes and litter to be included in the contract specification documents.	ECO to monitor Site engineer/site manager	During site establishment Weekly thereafter.
Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Damage or Destruction of Archaeological Resources During Clearing of the Ground or Excavation of Foundations		
A final walk-down survey of the authorised footprint must be carried out at least 6 months before the start of construction in order for any archaeological mitigation requirements to be determined and carried out.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
During the construction phase a chance-finds procedure must be applied should substantial fossil remains such as vertebrate bones, teeth or trackways, plant-rich fossil lenses or dense fossil burrow assemblages be exposed by excavation or discovered within the development footprint.	Environmental Control Officer should safeguard the fossils, preferably *in situ*, and alert the responsible heritage management authority, so that appropriate action can be taken by a professional palaeontologist	When required during construction
If any archaeological material or human burials are uncovered during the course of development then work in the immediate area must be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Throughout construction. Weekly checks.
Graves		
In the event of human bones being found on site, an archaeologist must be informed immediately and the remains removed under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.	ECO to monitor Site engineer/site manager	Throughout construction.

Mitigation Measure	Responsibility	Timing / Frequency
All identified grave yards must be mapped and co-ordinates given to the developer and the contractor. These areas must be avoided, as far a practical. The contractor is to ensure that the work force are aware of these areas, and buffers applied around them.	ECO to monitor Site engineer/site manager	Throughout construction.
A minimum 30 m buffer to be maintained around all graves, ruins and buildings	ECO to monitor Site engineer/site manager	Pre-construction and throughout construction
Creation of Local Employment, Training, and Business Opportunities		
The project proponent of Paulputs North WEF should liaise with the Khâi-Ma and Kai !Garib Local Municipalities to establish a local skills database for the associated areas. The existence of such a skills database should be made available to the contractors before the commencement of the construction phase to establish the extent of the available service providers in the local municipalities	Developer/ site manager	Pre-construction and throughout construction
The key stakeholders, local authorities and the community need to be informed regarding the outcome of the decision of the Paulputs North WEF. The potential employment opportunities and the employment procedure that the project proponent intends to follow should be clearly communicated before the commencement of the construction phase	Developer/ site manager	Pre-construction and throughout construction
Reasonable and practical efforts should be made by the project proponent to appoint local contractors by implementing a "locals first" policy. However, due to the technical nature of this project it is likely that skilled positions will be filled by people from outside the local areas	Developer/ site manager	Pre-construction and throughout construction
Where feasible a training and skills development programmes for local workers must be initiated prior to the initiation of the construction phase	Developer/ site manager	Pre-construction and throughout construction
Efforts should be made to employ local contractors first, and also contractors that are compliant with the Broad Based Black Economic Empowerment (BBBEE) criteria.	Developer/ site manager	Pre-construction and throughout construction
The recruitment selection process should also seek to promote gender equality.	Developer/ site manager	Pre-construction and throughout construction
If feasible training and skills development programmes for the local workers should be initiated prior to the initiation of the construction phase of the Paulputs North WEF.	Developer/ site manager	Pre-construction and throughout construction
Impacts of Construction Workers on Local Community and Influx of Job Seekers		
The project proponent should implement a "locals first" policy, where the local community of Pofadder and Kakamas should be employed first, specifically for un-skilled and low-skilled employment opportunities.	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
The project proponent should implement a policy that no employment opportunities will be available at the gate.	Developer/ site manager	Pre-construction and throughout construction
The proposed construction site for the Paulputs North WEF should be clearly fenced off for potential security risks in this regard.	Developer/ site manager	Pre-construction and throughout construction
It should be noted that although the significance of this impact is low, the influx of job seekers can not be avoided or prevented.	Developer/ site manager	Pre-construction and throughout construction
The project proponent and appointed contractors need to develop a code of conduct which must be signed by construction workers prior to the construction phase. The code of conduct should clearly outline the acceptable behaviour and activities of construction workers. In doing so construction workers will be legally informed and held liable for any damages or losses. It is however important that dismissals or fines must comply with the South African labour legislation.	Developer/ site manager	Pre-construction and throughout construction
The proposed site for the Paulputs North WEF should be clearly demarcated and fenced off to effectively monitor the movement of construction workers in the vicinity of the project site.	Developer/ site manager	Pre-construction and throughout construction
Transportation for the construction workers need to be arranged by the project proponent on a daily basis, and enable the proponent to effectively monitor the movement of construction workers to and from the project site. Where necessary arrangements need to be made by the project proponents to enable construction workers to return to their hometowns over weekends/on a regular basis to reduce the potential risks posed to local family structures and social networks.	Developer/ site manager	Pre-construction and throughout construction
No staff should be accommodated over-night on the construction site, except for the presence of security staff throughout the night on site due to security reasons for the landowners and their workers.	Developer/ site manager	Pre-construction and throughout construction
HIV/AIDS awareness programmes should be implement by the project proponent for the construction workers during the construction phase.	Developer/ site manager	Pre-construction and throughout construction
Maximising of opportunities to local and regional SMMEs and other businesses for service delivery.		
The project proponent of Paulputs WEF should liaise with the Khâi-Ma and Kai !Garib Local Municipalities to establish a database for the local companies/service providers of the associated areas. This database should be made available to the contractors before the initiation of the construction phase to notify and invite such service providers to tender for project-based services. However, it should be noted that a competitive tender process may not guarantee the employment of local service providers/companies and this should also be clearly communicated to potential contractors.	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
Efforts should be made by the project proponent to assist local Broad Based Black Economic Empowerment (BBBEE) companies regarding the application and submission of tenders.	Developer/ site manager	Pre-construction and throughout construction
Strategies need to be identified by the local municipalities and the local business sectors, in order to maximise the potential benefits which can be associated with the establishment of the Paulputs North WEF	Developer/ site manager	Pre-construction and throughout construction
Risk To Safety Of Farmers And Farm Workers, Livestock And Damage To Farm Infrastructure Associated With The Movement Of Construction Workers On And To The Site		
The proposed construction site for the Paulputs North WEF should be clearly fenced off and the movement of construction workers should be limited to the vicinity of the construction site.	Developer/ site manager	Pre-construction and throughout construction
The project proponent/ appointed contractors should provide transportation to the construction workers on a daily basis. This will ensure the potential risk regarding the trespassing of construction workers on farmers' properties, be reduced.	Developer/ site manager	Pre-construction and throughout construction
The project proponent and appointed contractors need to develop a code of conduct which must be signed by construction workers prior to the construction phase. The code of conduct should clearly outline the acceptable behaviour and activities of construction workers. In doing so construction workers will be legally informed and held liable for any damages/theft. Construction workers found guilty of such an offence should be charged and dismissed. It is however important that dismissals or fines must comply with the South African labour legislation.	Developer/ site manager	Pre-construction and throughout construction
The project proponent should enter into an agreement with the farmers prior to the construction phase, whereby the damages/losses to farming property/infrastructure be compensated for, if it can be proven to be associated with the construction activities of the proposed WEF.	Developer/ site manager ECO to monitor	Pre-construction and throughout construction
The project proponent should hold the appointed contractors liable for the compensation to farmers for any damages or losses that can be associated with the construction phase of the proposed project. This should also be included in the Code of Conduct signed by all key stakeholders.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The 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 must be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation.	Developer/ site manager Safety officer	Pre-construction and throughout construction
Procedures regarding waste management on the construction site should be clearly outlined in the Environmental Management Programme (EMPr), to reduce the risk it poses to livestock.	Developer/ site manager Safety officer	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
Potential Loss Of Livestock, Crops And Houses, Damage To Farm Infrastructure And Threat To Human Life Associated With Increased Incidence Of Grass Fires		
Firebreaks must be implemented by the contractor around the perimeters of the construction site.	Developer/ site manager	Pre-construction and throughout construction
The project proponent should enter into an agreement with the farmers prior to the construction phase, whereby the damages/losses to farming property/infrastructure due to fire risks be compensated for, if it can be proven to be associated with the construction activities of the proposed WEF.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
In the event of a fire due to construction related activities, the contractor must repair any damages caused to the farmers. The farmers need to be compensated for any damages caused due to fires borne during construction related activities. The costs with regards to firefighting should also be borne by the contractor.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The necessary precautionary measures need to be taken during high wind conditions and dry months	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
The appointed contractors should ensure that any construction related activities that might pose potential fire risks, for example welding and grinding, are confined to the designated areas and that it is properly managed.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Adequate fire-fighting equipment should be provided by the contractors and should be readily available and serviced on a regular basis. Additionally, all staff should be training in fire-fighting and how to use the related fire-fighting equipment.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
The appointed contractor should ensure that no open fires for the use of cooking or heating should be allowed, except for designated areas.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Potential Dust and Safety Impacts and Damage to Road Surfaces Associated with Movement of Construction Related Traffic to and from the Site		
The contractor must inform local farmers and representatives from the local and district municipality, of dates and times when abnormal loads will be undertaken.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
The contractor and developer must liaise with nearby solar farms to minimise potential impacts (e.g. minimise dust generation near existing solar farms and prevent damage to roads or other existing infrastructure).	Developer / Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
The contractor must ensure that damage caused by construction related traffic to the gravel public roads and local, 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.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis[2], adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The contractor must ensure that all construction vehicles adhere to speed limits and vehicles used to transport sand and building materials must be fitted with tarpaulins or covers.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
All workers must receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly; Speed limits must be applied. Construction vehicles limit of 40 km/hr on site.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
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 Safety officer and ECO	Pre-construction and throughout construction. Monthly
The Contractor must 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 must be fined.	Site engineer/ site manager Safety officer and ECO	Daily. Pre-construction and throughout construction
The Contractor must be required to collect waste along the road reserve on a daily basis.	Site engineer/ site manager ECO	Daily. Pre-construction and throughout construction
Waste generated during the construction phase must be transported to the registered landfill.	Site engineer/ site manager ECO	Weekly throughput construction
EMPr measures (and penalties) must be implemented to ensure farm gates are closed at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
EMPr measures (and penalties) must be implemented to ensure speed limits are adhered to at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
As far as possible, the transport of components to the site along the national road must be planned to avoid weekends and holiday periods.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction

[2] Treated effluent (non-potable) water must be used for wetting of roads and construction areas

Mitigation Measure	Responsibility	Timing / Frequency
The loss of farmlands for grazing of sheep and on associated farming activities		
The location of wind turbines, access roads, laydown areas etc. must be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils must be avoided;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
In addition, the project proponent should consult with the affected land owners for their inputs and comments on the finalization of the layout of the wind turbines and associated infrastructure, in order for landowners to factor in the construction activities and the impact thereof on their farmlands and farming activities	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
The proposed site for the Paulputs North WEF should be clearly demarcated and fenced-off prior to the construction phase. All construction related activities must be confined to this area	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
The implementation of a rehabilitation programme must be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme must be drawn up the Environmental Consultants appointed to undertake the amendment;	Site engineer/ site manager Developer to implement ECO	Tender phase
The footprint of the impact associated with the construction phase need to be kept to the minimum, and sheep need to be relocated to alternative farmlands for the period of the construction phase.	Site engineer/ site manager Developer to implement ECO	Weekly
It is advised that the construction phase take place in two phases and also to start with construction from one part of the site and gradually work the construction thereof through to the other part of the site to ensure that the disturbance to the landowners and their farming activities are kept to the minimum.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
All impacted areas disturbed during the construction phase must be rehabilitated at the end of the construction phase. Rehabilitation plans need to be informed by the soil and agricultural specialist studies.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Daily
An ECO must be appointed to continuously monitor the activities associated with the construction phase. The ECO should also apply social monitoring on a quarterly basis and monitor the implementation of the Rehabilitation Programme.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly

Mitigation Measure	Responsibility	Timing / Frequency
A Rehabilitation Programme should be implemented by the project proponents. The specifications hereof should be compiled by the appointed EIA practitioners and must be included in the project proponents terms of reference and also be included in the EMPr.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
In the case where a farmer experiences permanent loss of farmland due to the construction of the proposed Paulputs North WEF, the project proponents should compensate the farmer for the loss of the farmland as in the nature of the agreement made to the affected landowners.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
General Construction Mitigation Measures		
Portable toilets must be supplied to the workforce in areas of activity. One toilet per 14 workers must be implemented. Females must have separate toilets. A licenced contractor must be appointed by the contractor to provide this facility, and ensure that wastes are correctly disposed of. Servicing must take place on a weekly basis, proof of which must be retained on site by the contractor.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Waste skips must be provided in areas of construction activity as well as within the lay down areas, along with waste bins. Wastes must be separated into the following categories: • General waste, compactable and non-compactable • Waste paper recycling • Scrap metal • Globes and fluorescent tubes • Rubber waste • Medical waste • Chemical waste • Hazardous waste	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Health and Safety		
Implementation of safety measures, work procedures and first aid must be implemented on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Workers must be thoroughly trained in using potentially dangerous equipment	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly

Mitigation Measure	Responsibility	Timing / Frequency
Contractors must ensure that all equipment is maintained in a safe operating condition.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
A safety officer must be appointed.	Developer to implement	Pre-construction
A record of health and safety incidents must be kept on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Any health and safety incidents must be reported to the project manager immediately.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction.
First aid facilities must be available on site at all times.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
The contractor must ensure that all construction workers are well educated about HIV/ AIDS and the risks surrounding this disease. The location of the local clinic where more information and counselling is offered must be indicated to workers.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
An STI and HIV/AIDS awareness campaign must be launched, which is not only directed at construction workers but also at the community as a whole.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Condoms must be distributed by placing them at centrally located points and by ensuring that construction workers and community members are aware of the availability and location of condoms. The distribution of condoms must be approached with the necessary cultural sensitivity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Access at the construction site must be controlled to prevent sex workers from either visiting and/or loitering at the construction camp.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily

Mitigation Measure	Responsibility	Timing / Frequency
Ensure that the local community communicate their expectations of construction workers' behaviour with them.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Personal Protective Equipment (PPE) must be made available to all construction staff and their usage must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
No person is to enter the site without the necessary PPE.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Pre-construction, construction and operation activities must be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
The workforce is to be provided with sufficient potable water and under no circumstances are they to use untreated water from the local watercourses for drinking.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise		
Construction activities should be limited to times agreed with the local municipalities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
All construction vehicles and equipment are to be kept in good repair.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Deliveries of turbine components, plant and materials by HGV to site should only take place by designated routes and within times agreed with the relevant authorities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
The site contractors should employ the best practicable means of reducing noise emissions from plant, machinery and construction activities, as described in BS 5228.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily

Mitigation Measure	Responsibility	Timing / Frequency
Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day must be limited, blasting must be undertaken at the same times each day and no blasting must be allowed at night.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor and ECO must liaise with local residents on how best to minimise impact, and the local population must be kept informed of the nature and duration of intended activities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Where practicable, the work programme should be phased, which would help to reduce the combined effects arising from construction operations	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Any plant and equipment normally required for operation at night (19:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dB, LAeq at the nearest noise-sensitive receptors.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Traffic Congestion, Impedance to Traffic Flow due to Increase in Traffic Volumes		

Mitigation Measure	Responsibility	Timing / Frequency
Transport Management Plan to be produced to include: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site; • Design on-site roads to facilitate access to laydown areas, substations and wind turbines; • Conduct a dry-run prior to implementation of the Transport Management Plan.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Design Phase / Pre-construction
Minor Road Degradation due to Increased Traffic		
Document condition of gravel roads prior to construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Upgrade gravel roads to suitable condition for proposed construction vehicles.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that the minor road is left in a better condition post-construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Intersection Road Safety		
Place warning construction vehicle signage on the N14 and MN759.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles are roadworthy.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles have appropriate drivers licence.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.

In terms of minimising fire risk within the BESS and Substation site, the following design and implementation recommendations are proposed and should be considered prior to installation/construction of the BESS. These recommendations should form part of the Tactical Fire response plan where applicable.

Table 5-2: Proposed Design and Installation Considerations for the BESS

Initial Design Recommendations:
1. Fire department • Invite the fire department to the project site to discuss BESS hazards. An adequate emergency response is the key to avoiding an uncontrolled fire. Keep in mind that some fire fighters will not fully understand the hazards and may assume that lithium-ion batteries are the same as lithium batteries. • Key questions to discuss with the fire department include: – What is the main difference between extinguishing and cooling? – How to handle a damaged battery? – How to manage the flammable and toxic gases? • Plan training exercises with the fire department when the system is commissioned. • Standard Operating Procedures (SOP) & Standard Operating Guidelines (SOG) are of major importance and should be updated and tested on a regular basis.
2. Construction and location • Install the BESS outdoors, a minimum of 20 m from important buildings or equipment. Maintain a minimum of 3 m separation from lot lines, public ways and other exposures. • Within the module, maintain a minimum of 1 m separation distance between enclosures for all units up to 50 kWh when not listed, or up to 250 kWh when listed. • Install a thermal barrier where the minimum space separation cannot be provided. • If the BESS must be located indoors, install in a 2-hour fire rated cut-off room, which is accessible directly outdoors for manual firefighting. • Restrict the access to competent employees or sub-contractors. • Ensure enclosures are non-combustible.
3. Material, equipment and design • Paulputs North should consider a 'Testing Method' for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. A possible international standard to consider would be UL 9540A. This standard evaluates thermal runaway, gas composition, flaming, fire spread, re-ignition and the effectiveness of fire protection systems. Data generated can be used to determine the fire and explosion protection requirements for a BESS. • Place capacitor, transformer, and switch gear in separate rooms according to best engineering practices.
4. Ventilation and temperature control • Install adequate ventilation or an air conditioning system to control the temperature. Maintaining temperature control is vital to the battery's longevity and proper operation as they degrade exponentially at elevated temperatures. • Ensure ventilation is provided in accordance with the manufacturer's recommendations.

Initial Design Recommendations:
• Install and maintain the ventilation during all stages of a fire. Ventilation is important since batteries will continue to generate flammable gas as long as they are hot. Also, carbon monoxide will be generated until the batteries are completely cooled through to their core.
5. Gas detection and smoke detection • Install a very early warning fire detection system, such as aspirating smoke detection. • Install carbon monoxide (CO) detection within the container or BESS room.
6. Fire protection and water supply • Investigate the possibility of installing a sprinkler protection system within the BESS containers. The sprinkler system should be designed to provide (at a minimum) 12.2 l/min/m² over 232 m². Water has been proven to be the best agent to fight a fire involving lithium-Ion batteries. It is important to note that other extinguishing agents, such as aerosols or gaseous extinguishing systems, will extinguish the fire, but they do not provide cooling like water. Insufficient cooling allows a hot and deep-seated core to remain. The heat will rapidly spread back through the battery and reignite remaining active sections. • Implement a procedure for battery submersion in the Tactical Fire Reponses Plan, as well as the WEF Emergency Response Plan to be performed by the fire department. Submerging batteries in water (preferably outdoors) after they burn has proven to be effective at cooling the batteries and neutralizing the thermal threat. They will continue to release gases, mostly carbon monoxide, but also flammable gas such as hydrogen. Therefore, it is not recommended to submerge several batteries in a confined space without adequate ventilation. • Ensure that sufficient water is available for manual firefighting. The ability of the fire department to control a fire involving a BESS depends on the presence of an adequate water supply and their knowledge of the hazards. The following should be considered: – An external fire hydrant should be located within 100 m of the BESS room or containers. – The water supply should be able to provide a minimum of 1,900 l/min (500 gpm) for at least 2 hours.
1. Maintenance • Follow original equipment manufacturer recommendations for the inspection, testing and maintenance of the BESS. In addition, ensure that the following (at a minimum) is completed: – Measure the internal resistance of the battery cells. Replace the cells when a dramatic drop is detected. This will provide a good gauge of predictable battery life. – Perform infrared scanning at least once per year. – Check for fluid leakage. – Implement electric terminal torqueing procedures to maintain connection integrity.

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; and
- No alcohol or drugs are allowed on site.

6.1 Eating Areas

The Contractor shall designate eating areas to the approval of the Engineer which shall be clearly demarcated. Sufficient bins, as specified in 5.4 shall be present in this area. Any cooking on Site shall be done on well-maintained gas cookers with fire extinguishers present.

6.2 Drinking Water

The Contractor shall ensure that drinking water is available for all staff on site. If no potable water source is available on site then the Contractor shall import drinking water to the site.

6.3 Contaminated Water

Water containing such pollutants as cements, concrete, lime, chemicals, fuels and hydrocarbons shall be contained and discharged into an impermeable storage facility for removal from the site or for recycling. This particularly applies to water emanating from concrete batching plants and concrete swills, and to runoff from fuel depots/workshops/truck washing areas.

Wash down areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas are not polluted. The Contractor shall notify the Engineer immediately of any pollution incidents on Site.

If construction areas are to be pumped of water (e.g. after rains), this water must first be pumped into a settlement area, and not directly into a natural ecosystem.

A Method Statement shall be required for all wash areas where hydrocarbon and hazardous materials, and pollutants are expected to be used. This includes, but is not limited to, vehicle washing, workshop wash bays and paint equipment cleaning. Wash areas for domestic use shall ensure that the disposal of contaminated "grey" water is sanctioned by the Engineer.

6.4 Hazardous Substances

Hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) used during construction shall be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) shall be available on Site. Procedures detailed in the MSDS shall be followed in the event of an emergency situation.

If potentially hazardous substances are to be stored on site, the Contractor shall provide a Method Statement detailing the substances/ materials to be used, together with the storage, handling and disposal procedures of the materials.

No paint products and chemical additives and cleaners such as thinners and turpentine, may be disposed of on Site. Brush / roller wash facilities shall be established to the satisfaction of the Engineer. A Method Statement, approved by the Engineer, is required.

6.5 Workshop, Equipment, Maintenance and Storage

Where practical, all maintenance of plants on Site shall be performed in the workshop. If it is necessary to do maintenance outside of the workshop area, the Contractor shall obtain the approval of the Engineer prior to commencing activities.

The Contractor shall ensure that in the workshop and other plant maintenance facilities, including those areas where, after obtaining the Engineer's approval, the Contractor carries out emergency plant maintenance, there is no contamination of the soil or vegetation. The workshop shall have a smooth impermeable floor either constructed of concrete or thick plastic covered with sufficient sand to protect the plastic from damage. The floor shall be bunded and sloped towards an oil trap or sump to contain any spillages of substances (e.g. oil). A Method Statement detailing the design and construction of the workshop must be submitted.

When servicing equipment, drip trays shall be used to collect the waste oil and other lubricants. Drip trays shall also be provided in construction areas for stationary plant (such as compressors) and for "parked" plant (such as scrapers, loaders, vehicles).

All vehicles and equipment shall be kept in good working order and serviced regularly. Leaking equipment shall be repaired immediately or removed from the Site.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only. All washing shall be undertaken in the workshop or maintenance areas, and these areas must be equipped with a suitable impermeable floor and sump/oil trap. The use of detergents for washing shall be restricted to low phosphate and nitrate containing and low sudsing-type detergents.

In terms of the BESS, the following mitigation measures are necessary regarding the workshop, equipment, maintenance and storage of the BESS during construction:

- Regular inspection of containment/ bunding.
- Risk assessment to be conducted.
- Appropriate supervision.
- Adhere to handling and storage instructions.
- Site clean-up and rehabilitation response procedure.
- Use of suitable equipment.
- Equipment properly packaged/ bunded in line with regulations.
- Ensure that storage facilities meet OEM requirements.
- Specialist staff trained and accredited to appropriate standard

As mentioned above, a risk assessment is to be undertaken. The applicant must compile and implement the following additional programs to be submitted alongside the risk assessment to the Competent Authority prior to the operation of the BESS:

  - Thermal management and monitoring programme; and
  - BESS operations and maintenance programme

6.6 Dust Control

The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer and ECO. In extreme instances, the use of specific dust suppressant additives such as "Dustex" may be necessary in order to limit dust generation from haul roads.

During high wind conditions, the Contractor shall comply with the Engineers instructions regarding dust suppression measures. The Engineer may request the temporary cessation of all construction activities where wind speeds are unacceptably high, and until such time as wind speeds return to acceptable levels.

6.7 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 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.
- Training of all staff and employees on how to handle spillages, fires and electrocutions with regards to the BESS.
- Bunding of BESS containers during construction
- Implementation of spill handling and management, compiled specifically for the BESS.
- MSDS Records to be kept, as well as incidents reporting register to record any incidents relating to the BESS.
- Batteries are to be inspected prior to installation.
- Development and implementation of Thermal Management Plan prior to installation/construction.

Table 6.1 below provides the mitigation measures to be implemented for the potential impacts identified.

Table 6-1: Design and Construction Phase Mitigation Measures for the Proposed Development

Mitigation Measure	Responsibility	Timing / Frequency
Route Clearing		
Off-road driving and the creation of new tracks, other than those described during Project Layout and Access Plan, are prohibited and will be regarded as unwanted tracks or unwarranted disturbed areas. All unwanted tracks or unwarranted disturbed areas shall be properly rehabilitated.	Contractors engineer will be responsible for the creation of new roads. The ECO will be responsible for monitoring this activity	During site establishment Monthly thereafter.
When a new path is created: Carefully plan the route and have it clearly marked out so that drivers exactly know where to drive.	Site engineer/site manager ECO to monitor	Monthly
Establish the track by simply driving over the ground if there are no obvious obstacles (i.e. large rocks, high plants or rough terrain).	ECO to monitor Site engineer/site manager	
Keep tracks as narrow as possible and only drive on marked out routes (as per the Layout and Access Plan).		
No bulldozers will be used in bush clearing outside of the construction footprint. Only inflatable tyre earthmoving equipment must be used to reduce damage to vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If obstacles are far enough apart, divert the track around obstacles. Only obstacles that could interfere with the safe construction and operation of the development need to be removed.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Where possible, remove obstacles by hand. Shrubs are to be cut or crushed rather than being completely uprooted in areas where landscaping or rehabilitation will be undertaken on completion of the construction. Leave vegetation in place wherever possible, especially around the perimeter of the site to provide screening and habitat. Indigenous plants can be planted to replace alien vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Only undertake earthworks in an area if it is unavoidable, and keep the size of platforms as small as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Sensitive sites within the construction area must be demarcated to avoid accidental destruction of sensitive areas. The workforce must be made aware of these areas, and why they are sensitive.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impacts on Vegetation and Listed or Protected Plant Species Resulting from Construction Activities		

Mitigation Measure	Responsibility	Timing / Frequency
Preconstruction walk-through of the approved development footprint by a qualified specialist to ensure that sensitive habitats and species are avoided where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Compile Quiver Tree Monitoring Programme and submit to DENC for review. Following DENC approval implement the Quiver Tree Monitoring Programme.	Developer / Operator ECO	Throughout operation. Monthly checks
Search and Rescue of species of conservation concern (SCCs) must be conducted prior to clearing activities and must be overseen by a botanist knowledgeable with the vegetation of the area and the rehabilitation of this type of vegetation.	ECO to monitor Site engineer/site manager	During site establishment
Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All construction vehicles must adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Temporary lay-down areas must be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas must be rehabilitated after use.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Ensure that lay-down and other temporary infrastructure is within low- sensitivity areas.	ECO to monitor Site engineer/site manager	Design Phase During site establishment
Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment and post construction
The exact routing of the roads must be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-through of the facility.	Developer / Site Engineer ECO to monitor	Design Phase Pre-Construction

Mitigation Measure	Responsibility	Timing / Frequency
	Site engineer/site manager	ECO to monitor throughout construction.
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	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.
Alien Plant Invasion Risk		
Wherever excavation is necessary, topsoil must be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
The recovery of the indigenous grass layer must be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
An alien plant management plan must be submitted as part of the EMPR to be approved by the DEA and implemented on site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Regular alien clearing must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increased Erosion Risk and Soil Degradation		
Dust suppression and erosion management must be an integrated component of the construction approach.	ECO to monitor Site engineer/site manager	Weekly
Regular monitoring for erosion problems along the access roads and other cleared areas.	ECO to monitor Site engineer/site manager	Weekly
Erosion problems must be rectified on a regular basis.	ECO to monitor Site engineer/site manager	Weekly

Mitigation Measure	Responsibility	Timing / Frequency
Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.	ECO to monitor Site engineer/site manager	Monthly
A low cover of vegetation must be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Disturbance near to drainage lines or the pan must be avoided and sensitive drainage areas near to the construction activities must be demarcated as no-go areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If an activity will mechanically disturb the soil below surface in any way, then any available topsoil must first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Direct Faunal Impacts		
All personnel must 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 persecuted out of superstition.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction walk-through of the facility to identify areas of faunal sensitivity such as occupied burrows	Developer ECO to monitor Site manager	Pre- construction.
Any fauna threatened by the construction activities must be removed to safety by the ECO or appropriately qualified environmental officer.	ECO to monitor Site engineer/site manager	During site establishment Weekly.
All construction vehicles must adhere to a low speed limit to avoid collisions with susceptible species.	ECO to monitor Site engineer/site manager / safety officer	During site establishment. Weekly.
During construction any fauna directly threatened by the construction activities must be removed to a safe location by the ECO or other suitably qualified person.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
The illegal collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. Personnel must not be allowed to wander off the construction site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.
No fires must be allowed on site as the vegetation is vulnerable to runaway fires.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.
No fuelwood collection must be allowed on-site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
No dogs or cats must be allowed on site at the construction camps apart from those of the landowners.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
If any parts of site such as construction camps must be lit at night, this must be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which must be directed downwards	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No unauthorized persons must be allowed onto the site and site access must be strictly controlled.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
All construction vehicles must adhere to a low speed limit (40km/h for cars and 30km/h for trucks). Speed limits must apply within the facility as well as on the public gravel access roads to the site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up in the appropriate manner as related to the nature of the spill.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If trenches need to be dug for water pipelines or electrical cabling, these must not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open must have places where there are soil ramps allowing fauna to escape the trench.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Loss of Rare, Endemic or Protected Species		

Mitigation Measure	Responsibility	Timing / Frequency
All alien plant re-growth, which is currently high within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Monthly.
A final pre-construction walkdown must be conducted, as part of a Plant Search and Rescue plan, with the appropriate permits in place.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Where any roads and crossings will be upgraded, the following applies: 1. All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised. 2. River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase. 3. Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion. Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. During site establishment. Monthly thereafter.
Loss of Functional Habitat within the Site and Near Any of the Required Crossing Upgrades		
All alien plant re-growth must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment. Monthly thereafter.
All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. Monthly thereafter.
Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
Avifaunal Habitat Destruction		
High traffic areas and buildings such as offices, batching plants, storage areas etc. must be situated in areas that are already disturbed, if available.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Existing roads and farm tracks must be used where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
The minimum footprint area possible of infrastructure must be used, including road widths and lengths.	ECO to monitor Site engineer/site manager	Prior to construction
During construction laydown areas and temporary access roads must be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off road driving.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Highly sensitive zones and no-go areas (e.g. nesting areas) must be cordoned off, clearly marked and avoided unless absolutely necessary.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Prior to construction, the avifaunal specialist must conduct a site walkthrough, covering the final internal and access and internal power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities need to be excluded and/or the schedules adjusted.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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 and included within the EMPR.	ECO to monitor Site engineer/site manager	Post construction
All contractors are to adhere to the EMPr and must apply good environmental practice during construction.	ECO to monitor Site engineer/site manager	Throughout construction
Turbines must not be constructed within any High Sensitivity Zones	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction

Mitigation Measure	Responsibility	Timing / Frequency
Disruption of Local Bird Movement Patterns		
Turbines must not be constructed within any high sensitivity zones identified through pre-construction monitoring and impact assessment.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction
The lowest feasible number of turbines should be constructed for the required MW output. Therefore, fewer larger (i.e with a higher MW output) turbine models should be favoured where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction
Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species, if acceptable to the Civil Aviation Authority.		
Avifaunal Disturbance and Displacement		
Prior to construction, the avifaunal specialist must conduct a site walkthrough, covering the final internal and access roads as well as the final turbine positions, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results must inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	ECO to monitor Site engineer/site manager	Monthly and when required.
During Construction, if any of the Priority Species or Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity (e.g. within 500 m of the power line), the Avifaunal Specialist is to be contacted immediately for further instruction, while a 'no go' buffer of 300 m is to be instituted around the nest site until the specialist has given further instructions.	ECO to monitor Site engineer/site manager	Pre-construction, post final design
No nests are to be disturbed or moved.	ECO to monitor Site engineer/site manager	As per specialist requirements.
Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be clearly marked, cordoned off and avoided unless absolutely necessary.	Developer / Site Engineer ECO to monitor Site engineer/site manager	As per specialist requirements.
Bird collisions		
Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species, if acceptable to the Civil Aviation Authority.	Developer / Operator to implement. ECO to Monitor.	Pre-Construction Design Phase.

Mitigation Measure	Responsibility	Timing / Frequency
Bat Roost Disturbance and/or Destruction		
Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and must be the primary mitigation measure. Low lying areas, buildings, woodland/thicket and areas near water must be avoided.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
It is recommended that a bat specialist survey the confirmed turbine locations and all other proposed site infrastructure for the presence of roosts within 200 m before any construction activities commence and once the preliminary design and layout of each WEF is complete.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
It is recommended that a bat specialist surveys the confirmed turbine locations and the locations of all other site infrastructure, such as pylons, for the presence of occupied roosts among the potential roosts before any construction activities commence and once the preliminary design and layout of the site is complete.	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.
If occupied roosts are confirmed these must be buffered based on best practise guidance, which includes a minimum buffer of 200 m.	Developer ECO	Pre-construction / design phase.
Clearing of natural and agricultural areas be kept to a minimum.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Dust suppression measures to be used during the full construction phase.	ECO to monitor Site engineer/site manager	Weekly
Any new roosts discovered, must be reported and incorporated into the adaptive management plan.	ECO to monitor Site engineer/site manager	Monthly and as required during construction
Bat Habitat Modification		
Clearing of natural and agricultural areas be kept to a minimum	ECO to monitor Site engineer/site manager	Pre-construction / design phase. Monthly thereafter.
Before construction commences, a bat specialist must conduct a site walkthrough, covering the final internal and external road and internal power line routes as well as the final turbine positions.	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.

Mitigation Measure	Responsibility	Timing / Frequency
During construction laydown areas and temporary access roads must be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off-road driving	ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and a habitat restoration plan must be developed by a specialist	ECO to monitor Site engineer/site manager	Post construction. Weekly.
Loss of Riparian Systems and Disturbance of the Alluvial Watercourses		
Where new 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 (reduce footprint as much as possible).	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No vehicles to refuel within drainage lines/ riparian vegetation.	ECO to monitor Site engineer/site manager	Weekly
Monitor culverts to see if erosion issues arise and if any erosion control if required.	ECO to monitor Site engineer/site manager	monthly
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas within aquatic environment, using selected species detailed in this report	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All alien plant re-growth must be monitored, and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on Riparian Systems through the Possible Increase in Surface Water Runoff from Hard Surfaces and or Roads on Riparian Form and Function		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Timing / Frequency
Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.	ECO to monitor	During site establishment Monthly thereafter.
No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation	Site engineer/site manager	During site establishment Monthly thereafter.
Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas or have steep embankments.	ECO to monitor	During site establishment Monthly thereafter.
Increase in Sedimentation and Erosion within the Development Footprint		
Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities. Any management actions must be dealt with in the Stormwater Management Plan (SWMP) typically submitted post EA, forming part of any WULA.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on Localized Surface Water Quality		
Strict use and management of all hazardous materials used on site in line with the specific material safety data sheets, e.g. fuels must be stored within a contained / bunded site with the necessary and spill kits available.	ECO to monitor Site engineer/site manager	Weekly
Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).	ECO to monitor Site engineer/site manager	Weekly
Containment of all contaminated water by means of careful run-off management on the development site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Strict control over the behaviour of construction workers.	ECO and safety to monitor Site engineer/site manager	Weekly
Working protocols incorporating pollution control measures (including approved method statements by the contractor) must be clearly set out in the EMPR for the project and strictly enforced.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Appropriate ablution facilities must be provided for construction workers during construction and on-site staff during the operation of the facility (generally accepted 1:14 separate male and female facilities).	ECO to monitor Site engineer/site manager	Weekly
Potential Visual Effect of Construction Activities, including Cranes, Construction Traffic, Dust and Noise Affecting the Rural Sense of Place		
Carefully plan to mimimise the construction period and avoid construction delays	Site engineer/site manager	Design phase

Mitigation Measure	Responsibility	Timing / Frequency
Inform receptors of the construction programme and schedules	ECO to monitor Site engineer/site manager	Design phase
Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing should take place in a phased manner.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Maintain a neat construction site by removing rubble and waste materials regularly.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Make use of existing gravel access roads where possible	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Limit the number of vehicles and trucks travelling to and from the proposed site, where possible	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Unless there are water shortages, ensure that dust suppression techniques are implemented – on all access roads; – in all areas where vegetation clearing has taken place; – on all soil stockpiles.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Visual Mitigation During Construction		
Access and haul roads to use existing farm tracks as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Weekly
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Measures to control wastes and litter to be included in the contract specification documents.	ECO to monitor Site engineer/site manager	During site establishment Weekly thereafter.
Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.	ECO to monitor	During site establishment

Mitigation Measure	Responsibility	Timing / Frequency
	Site engineer/site manager	Monthly thereafter.
Damage or Destruction of Archaeological Resources During Clearing of the Ground or Excavation of Foundations		
A final walk-down survey of the authorised footprint must be carried out at least 6 months before the start of construction in order for any archaeological mitigation requirements to be determined and carried out.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
During the construction phase a chance-finds procedure must be applied should substantial fossil remains such as vertebrate bones, teeth or trackways, plant-rich fossil lenses or dense fossil burrow assemblages be exposed by excavation or discovered within the development footprint.	Environmental Control Officer should safeguard the fossils, preferably *in situ*, and alert the responsible heritage management authority, so that appropriate action can be taken by a professional palaeontologist	When required during construction
If any archaeological material or human burials are uncovered during the course of development then work in the immediate area must be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Throughout construction. Weekly checks.
Graves		
In the event of human bones being found on site, an archaeologist must be informed immediately and the remains removed under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.	ECO to monitor Site engineer/site manager	Throughout construction.
All identified grave yards must be mapped and co-ordinates given to the developer and the contractor. These areas must be avoided, as far a practical. The contractor is to ensure that the work force are aware of these areas, and buffers applied around them.	ECO to monitor Site engineer/site manager	Throughout construction.
A minimum 30 m buffer to be maintained around all graves, ruins and buildings	ECO to monitor Site engineer/site manager	Pre-construction and throughout construction
Creation of Local Employment, Training, and Business Opportunities		

Mitigation Measure	Responsibility	Timing / Frequency
The project proponent of Paulputs North WEF should liaise with the Khâi-Ma and Kai !Garib Local Municipalities to establish a local skills database for the associated areas. The existence of such a skills database should be made available to the contractors before the commencement of the construction phase to establish the extent of the available service providers in the local municipalities	Developer/ site manager	Pre-construction and throughout construction
The key stakeholders, local authorities and the community need to be informed regarding the outcome of the decision of the Paulputs North WEF. The potential employment opportunities and the employment procedure that the project proponent intends to follow should be clearly communicated before the commencement of the construction phase	Developer/ site manager	Pre-construction and throughout construction
Reasonable and practical efforts should be made by the project proponent to appoint local contractors by implementing a "locals first" policy. However, due to the technical nature of this project it is likely that skilled positions will be filled by people from outside the local areas	Developer/ site manager	Pre-construction and throughout construction
Where feasible a training and skills development programmes for local workers must be initiated prior to the initiation of the construction phase	Developer/ site manager	Pre-construction and throughout construction
Efforts should be made to employ local contractors first, and also contractors that are compliant with the Broad Based Black Economic Empowerment (BBBEE) criteria.	Developer/ site manager	Pre-construction and throughout construction
The recruitment selection process should also seek to promote gender equality.	Developer/ site manager	Pre-construction and throughout construction
If feasible training and skills development programmes for the local workers should be initiated prior to the initiation of the construction phase of the Paulputs North WEF.	Developer/ site manager	Pre-construction and throughout construction
Impacts of Construction Workers on Local Community and Influx of Job Seekers		
The project proponent should implement a "locals first" policy, where the local community of Pofadder and Kakamas should be employed first, specifically for un-skilled and low-skilled employment opportunities.	Developer/ site manager	Pre-construction and throughout construction
The project proponent should implement a policy that no employment opportunities will be available at the gate.	Developer/ site manager	Pre-construction and throughout construction
The proposed construction site for the Paulputs North WEF should be clearly fenced off for potential security risks in this regard.	Developer/ site manager	Pre-construction and throughout construction
It should be noted that although the significance of this impact is low, the influx of job seekers can not be avoided or prevented.	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
The project proponent and appointed contractors need to develop a code of conduct which must be signed by construction workers prior to the construction phase. The code of conduct should clearly outline the acceptable behaviour and activities of construction workers. In doing so construction workers will be legally informed and held liable for any damages or losses. It is however important that dismissals or fines must comply with the South African labour legislation.	Developer/ site manager	Pre-construction and throughout construction
The proposed site for the Paulputs North WEF should be clearly demarcated and fenced off to effectively monitor the movement of construction workers in the vicinity of the project site.	Developer/ site manager	Pre-construction and throughout construction
Transportation for the construction workers need to be arranged by the project proponent on a daily basis, and enable the proponent to effectively monitor the movement of construction workers to and from the project site. Where necessary arrangements need to be made by the project proponents to enable construction workers to return to their hometowns over weekends/on a regular basis to reduce the potential risks posed to local family structures and social networks.	Developer/ site manager	Pre-construction and throughout construction
No staff should be accommodated over-night on the construction site, except for the presence of security staff throughout the night on site due to security reasons for the landowners and their workers.	Developer/ site manager	Pre-construction and throughout construction
HIV/AIDS awareness programmes should be implement by the project proponent for the construction workers during the construction phase.	Developer/ site manager	Pre-construction and throughout construction
Maximising of opportunities to local and regional SMMEs and other businesses for service delivery.		
The project proponent of Paulputs WEF should liaise with the Khâi-Ma and Kai !Garib Local Municipalities to establish a database for the local companies/service providers of the associated areas. This database should be made available to the contractors before the initiation of the construction phase to notify and invite such service providers to tender for project-based services. However, it should be noted that a competitive tender process may not guarantee the employment of local service providers/companies and this should also be clearly communicated to potential contractors.	Developer/ site manager	Pre-construction and throughout construction
Efforts should be made by the project proponent to assist local Broad Based Black Economic Empowerment (BBBEE) companies regarding the application and submission of tenders.	Developer/ site manager	Pre-construction and throughout construction
Strategies need to be identified by the local municipalities and the local business sectors, in order to maximise the potential benefits which can be associated with the establishment of the Paulputs North WEF	Developer/ site manager	Pre-construction and throughout construction
Risk To Safety Of Farmers And Farm Workers, Livestock And Damage To Farm Infrastructure Associated With The Movement Of Construction Workers On And To The Site		

Mitigation Measure	Responsibility	Timing / Frequency
The proposed construction site for the Paulputs North WEF should be clearly fenced off and the movement of construction workers should be limited to the vicinity of the construction site	Developer/ site manager	Pre-construction and throughout construction
The project proponent/ appointed contractors should provide transportation to the construction workers on a daily basis. This will ensure the potential risk regarding the trespassing of construction workers on farmers' properties, be reduced.	Developer/ site manager	Pre-construction and throughout construction
The project proponent and appointed contractors need to develop a code of conduct which must be signed by construction workers prior to the construction phase. The code of conduct should clearly outline the acceptable behaviour and activities of construction workers. In doing so construction workers will be legally informed and held liable for any damages/theft. Construction workers found guilty of such an offence should be charged and dismissed. It is however important that dismissals or fines must comply with the South African labour legislation.	Developer/ site manager	Pre-construction and throughout construction
The project proponent should enter into an agreement with the farmers prior to the construction phase, whereby the damages/losses to farming property/infrastructure be compensated for, if it can be proven to be associated with the construction activities of the proposed WEF.	Developer/ site manager ECO to monitor	Pre-construction and throughout construction
The project proponent should hold the appointed contractors liable for the compensation to farmers for any damages or losses that can be associated with the construction phase of the proposed project. This should also be included in the Code of Conduct signed by all key stakeholders.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The 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 must be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;	Developer/ site manager Safety officer	Pre-construction and throughout construction
Procedures regarding waste management on the construction site should be clearly outlined in the Environmental Management Programme (EMPr), to reduce the risk it poses to livestock.	Developer/ site manager Safety officer	Pre-construction and throughout construction
Potential Loss Of Livestock, Crops And Houses, Damage To Farm Infrastructure And Threat To Human Life Associated With Increased Incidence Of Grass Fires		
Firebreaks must be implemented by the contractor around the perimeters of the construction site.	Developer/ site manager	Pre-construction and throughout construction
The project proponent should enter into an agreement with the farmers prior to the construction phase, whereby the damages/losses to farming property/infrastructure due to fire risks be compensated for, if it can be proven to be associated with the construction activities of the proposed WEF.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
In the event of a fire due to construction related activities, the contractor must repair any damages caused to the farmers. The farmers need to be compensated for any damages caused due to fires borne during construction related activities. The costs with regards to firefighting should also be borne by the contractor.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The necessary precautionary measures need to be taken during high wind conditions and dry months	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
The appointed contractors should ensure that any construction related activities that might pose potential fire risks, for example welding and grinding, are confined to the designated areas and that it is properly managed.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Adequate fire-fighting equipment should be provided by the contractors and should be readily available and serviced on a regular basis. Additionally, all staff should be training in fire-fighting and how to use the related fire-fighting equipment.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
The appointed contractor should ensure that no open fires for the use of cooking or heating should be allowed, except for designated areas.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Potential Dust and Safety Impacts and Damage to Road Surfaces Associated with Movement of Construction Related Traffic to and from the Site		
The contractor must inform local farmers and representatives from the local and district municipality, of dates and times when abnormal loads will be undertaken.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
The contractor and developer must liaise with nearby solar farms to minimise potential impacts (e.g. minimise dust generation near existing solar farms and prevent damage to roads or other existing infrastructure).	Developer / Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
The contractor must ensure that damage caused by construction related traffic to the gravel public roads and local, 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.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis[3], adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The contractor must ensure that all construction vehicles adhere to speed limits and vehicles used to transport sand and building materials must be fitted with tarpaulins or covers;	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction

[3] Treated effluent (non-potable) water must be used for wetting of roads and construction areas

Mitigation Measure	Responsibility	Timing / Frequency
All workers must receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly; Speed limits must be applied. Construction vehicles limit of 40 km/hr on site.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
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 Safety officer and ECO	Pre-construction and throughout construction. Monthly
The Contractor must 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 must be fined.	Site engineer/ site manager Safety officer and ECO	Daily. Pre-construction and throughout construction
The Contractor must be required to collect waste along the road reserve on a daily basis.	Site engineer/ site manager ECO	Daily. Pre-construction and throughout construction
Waste generated during the construction phase must be transported to the registered landfill.	Site engineer/ site manager ECO	Weekly throughput construction
EMPr measures (and penalties) must be implemented to ensure farm gates are closed at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
EMPr measures (and penalties) must be implemented to ensure speed limits are adhered to at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
As far as possible, the transport of components to the site along the national road must be planned to avoid weekends and holiday periods	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The loss of farmlands for grazing of sheep and on associated farming activities		
The location of wind turbines, access roads, laydown areas etc. must be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils must be avoided;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
In addition, the project proponent should consult with the affected land owners for their inputs and comments on the finalization of the layout of the wind turbines and associated infrastructure, in order for landowners to factor in the construction activities and the impact thereof on their farmlands and farming activities	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
The proposed site for the Paulputs North WEF should be clearly demarcated and fenced-off prior to the construction phase. All construction related activities must be confined to this area	Site engineer/ site manager	Weekly post construction

Mitigation Measure	Responsibility	Timing / Frequency
	Developer to implement ECO	
The implementation of a rehabilitation programme must be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme must be drawn up the Environmental Consultants appointed to undertake the amendment;	Site engineer/ site manager Developer to implement ECO	Tender phase
The footprint of the impact associated with the construction phase need to be kept to the minimum, and sheep need to be relocated to alternative farmlands for the period of the construction phase.	Site engineer/ site manager Developer to implement ECO	Weekly
It is advised that the construction phase take place in two phases and also to start with construction from one part of the site and gradually work the construction thereof through to the other part of the site to ensure that the disturbance to the landowners and their farming activities are kept to the minimum.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
All impacted areas disturbed during the construction phase must be rehabilitated at the end of the construction phase. Rehabilitation plans need to be informed by the soil and agricultural specialist studies.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Daily
An Environmental Control Officer (ECO) must be appointed to continuously monitor the activities associated with the construction phase. The ECO should also apply social monitoring on a quarterly basis and monitor the implementation of the Rehabilitation Programme.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
A Rehabilitation Programme should be implemented by the project proponents. The specifications hereof should be compiled by the appointed EIA practitioners and must be included in the project proponents terms of reference and also be included in the EMPr.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
In the case where a farmer experiences permanent loss of farmland due to the construction of the proposed Paulputs North WEF, the project proponents should compensate the farmer for the loss of the farmland as in the nature of the agreement made to the affected landowners.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
General Construction Mitigation Measures		

Mitigation Measure	Responsibility	Timing / Frequency
Portable toilets must be supplied to the workforce in areas of activity. One toilet per 14 workers must be implemented. Females must have separate toilets. A licenced contractor must be appointed by the contractor to provide this facility, and ensure that wastes are correctly disposed of. Servicing must take place on a weekly basis, proof of which must be retained on site by the contractor.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Waste skips must be provided in areas of construction activity as well as within the lay down areas, along with waste bins. Wastes must be separated into the following categories: • General waste, compactable and non-compactable • Waste paper recycling • Scrap metal • Globes and fluorescent tubes • Rubber waste • Medical waste • Chemical waste • Hazardous waste	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Health and Safety		
Implementation of safety measures, work procedures and first aid must be implemented on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Workers must be thoroughly trained in using potentially dangerous equipment	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Contractors must ensure that all equipment is maintained in a safe operating condition.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
A safety officer must be appointed.	Developer to implement	Pre-construction
A record of health and safety incidents must be kept on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly

Mitigation Measure	Responsibility	Timing / Frequency
Any health and safety incidents must be reported to the project manager immediately.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction.
First aid facilities must be available on site at all times.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Workers have the right to refuse work in unsafe conditions.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Daily
The contractor must ensure that all construction workers are well educated about HIV/ AIDS and the risks surrounding this disease. The location of the local clinic where more information and counselling is offered must be indicated to workers.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
An STI and HIV/AIDS awareness campaign must be launched, which is not only directed at construction workers but also at the community as a whole.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Condoms must be distributed by placing them at centrally located points and by ensuring that construction workers and community members are aware of the availability and location of condoms. The distribution of condoms must be approached with the necessary cultural sensitivity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Access at the construction site must be controlled to prevent sex workers from either visiting and/or loitering at the construction camp.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Ensure that the local community communicate their expectations of construction workers' behaviour with them.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
Personal Protective Equipment (PPE) must be made available to all construction staff and their usage must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
No person is to enter the site without the necessary PPE.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Pre-construction, construction and operation activities must be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
The workforce is to be provided with sufficient potable water and under no circumstances are they to use untreated water from the local watercourses for drinking.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise		
Construction activities should be limited to times agreed with the local municipalities	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
All construction vehicles and equipment are to be kept in good repair.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Deliveries of turbine components, plant and materials by HGV to site should only take place by designated routes and within times agreed with the relevant authorities	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
The site contractors should employ the best practicable means of reducing noise emissions from plant, machinery and construction activities, as described in BS 5228	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day must be limited, blasting must be undertaken at the same times each day and no blasting must be allowed at night.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor and ECO must liaise with local residents on how best to minimise impact, and the local population must be kept informed of the nature and duration of intended activities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Where practicable, the work programme should be phased, which would help to reduce the combined effects arising from construction operations	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Any plant and equipment normally required for operation at night (19:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dB, LAeq at the nearest noise-sensitive receptors.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Traffic Congestion, Impedance to Traffic Flow due to Increase in Traffic Volumes		
Transport Management Plan to be produced to include: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site; • Design on-site roads to facilitate access to laydown areas, substations and wind turbines; • Conduct a dry-run prior to implementation of the Transport Management Plan.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Design Phase / Pre-construction
Minor Road Degradation due to Increased Traffic		

Mitigation Measure	Responsibility	Timing / Frequency
Document condition of gravel roads prior to construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Upgrade gravel roads to suitable condition for proposed construction vehicles.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that the minor road is left in a better condition post-construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Intersection Road Safety		
Place warning construction vehicle signage on the N14 and MN759.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles are roadworthy.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles have appropriate drivers licence.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.

6.8 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 must 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.

6.8.1 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.

6.8.2 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.

6.8.3 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 and associated infrastructure is completed the project becomes operational. The operator of the WEF and associated infrastructure has the responsibility to ensure that the mitigation measures proposed for the operational phase is implemented and conducted appropriately.

During the operation and maintenance of the WEF (including the normal operation of the turbines themselves) a certain amount of disturbance results. An operational WEF will normally have various day to day activities occurring on site, such as (but not limited to) security control, routine maintenance, road clearing/cleaning, grass/bush cutting and clearing.

These factors can all lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Larsen & Madsen 2000; Percival 2005). Turbines can also be disruptive to bird flight paths, with some species altering their routes to avoid them (Dirksen *et al.* 1998, Tulp *et al.* 1999, Pettersson & Stalin 2003). While this reduces the chance of collisions it can also create a displacement or barrier effect, for example between roosting and feeding grounds and result in an increased energy expenditure and lower breeding success (Percival 2005).

Disturbance distances (the distance from wind farms up to which birds are absent or less abundant than expected) can vary between species and also within species with alternative habitat availability (Drewitt & Langston 2006). Some studies have recorded distances of 80 m, 100 m, 200 m and 300 m (Larsen & Madsen 2000, Shaffer & Buhl 2015) but distances of 600 m (Kruckenberg & Jaehne 2006) and up to 800 m have been recorded (Drewitt & Langston 2006).

Raptors are generally fairly tolerant of wind farms, and continue to use the area for foraging (Thelander *et al.* 2003, Madders & Whitfield 2006), so are not affected by displacement, which however increases their collision risk.

WEFs have the potential to impact bats directly through collisions and barotrauma resulting in mortality (Horn et al. 2008; Rollins et al. 2012), and indirectly through the modification of habitats (Kunz et al. 2007b). Direct impacts pose the greatest risk to bats and, in the context of the project, habitat loss and displacement should not pose a significant risk (unless a large roost in discovered on site and bats are reluctant to leave this roost if disturbed) because the project footprint (i.e. turbines, roads and infrastructure) is small relative to the area monitored.

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 Mitigation Measures

Table 7.1 presents the mitigation measure to be implemented for the potential impacts identified.

Table 7-1: Operational Phase Mitigation Measures

Mitigation Measure	Responsibility	Timing / Frequency
Ecology		
Compile Quiver Tree Monitoring Programme and submit to DENC for review. Following DENC approval implement the Quiver Tree Monitoring Programme.	Developer / Operator ECO	Throughout operation. Monthly checks
Management of the site must take place within the context of an Open Space Management Plan. A draft Open Space Management Plan is included in this EMPR and must be updated once the final site development plan is finalised and submitted to the DEA for approval.	Developer / Operator ECO	Throughout operation. Monthly checks
Erosion management at the site must take place according to the Erosion Management Plan and Rehabilitation Plan. A draft Erosion Management Plan and Rehabilitation Plan is included in this EMPR and must be updated once the final site development plan is finalised and submitted to the DEA for approval.	Developer / Operator ECO	Throughout operation. Monthly checks
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.	Developer / Operator ECO	Throughout operation. Monthly checks
Update and implement the Invasive Alien Plant Management Plan.	Developer / Operator ECO	Throughout operation. Monthly checks
Wherever excavation is necessary, topsoil must be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. The recovery of the indigenous shrub/grass layer must be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 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. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as these are also likely to be prone to invasion problems. Regular alien clearing must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
All roads and other hardened surfaces must have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
All cleared areas must be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.		
No unauthorized persons must be allowed onto the site. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities must be removed to a safe location. The collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. If the site must be lit at night for security purposes, this must be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. All hazardous materials must 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 must adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species. If parts of the facility are to be fenced, then no electrified strands must be placed within 30cm of the ground as some species 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 must be placed on the inside of the fence and not the outside.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Birds		
Develop and implement a carcass search programme for birds during the first two years of operation, in line with the applicable (i.e. at the start of operations at the wind farm) South African monitoring guidelines.	Developer to implement. Specialists to be appointed.	Operational Phase. Monthly checks.
The on-site WEF manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Wind Farm, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Operational Phase. Monthly checks.
Develop and implement a 24 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Operational Phase. Monthly checks.

Mitigation Measure	Responsibility	Timing / Frequency
Frequent and regular review of operational phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review should also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Throughout operation. Monthly checks.
The above reviews should strive to identify sensitive locations at the development including turbines that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. As a starting point for the review of possible mitigations, the following may need to be considered: – Assess the suitability of using deterrent devices (e.g. DT Bird and ultrasonic/ radar/ electromagnetic deterrents for bats) to reduce collision risk. – Identify options to modify turbine operation (e.g. temporary curtailment or shutdown on demand) to reduce collision risk if absolutely necessary and other methods have not had the desired results.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
BFDs must be maintained and replaced where necessary, for the life span of the project and any collision incidents be reported to the Endangered Wildlife Trust (EWT). Prior to construction, an avifaunal specialist must be consulted to provide recommendations regarding the most appropriate (and latest available technology) device to be used. The specialist should also conduct a pre-construction walk-though of the final approved pylon positions to determine which (if any) spans may require specialised marking with nocturnal solar powered LED devices	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins *et al.* 2015).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
Bats		
Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e. such as on turbines) and at ground level.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
If mortality does occur beyond threshold levels as determined based on applicable guidance (MacEwan et al. 2018), mitigation needs to be considered. Mitigation options may include using ultrasonic deterrents, raising the cut-in speeds of turbines and turbine blade feathering. Any operational minimization strategy (i.e. curtailment) should be targeted during specific seasons and time periods for specific turbines coincident with periods of increased bat activity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
Apply curtailment during February, August and October based on Bat Curtailment Plan if mortality does occur beyond threshold levels as determined based on applicable guidelines.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Throughout operation. Monthly checks.
Operational monitoring according to Aronson *et al.* (2014) or any more recent revisions to this document, reporting and adaptive management will be key to keeping the residual impact of the facility as low as possible. This data must be fed into the SANBI database to assist with enhancing the scientific knowledge base for information decision making and mitigation recommendations	Site engineer/ site manager Developer to implement ECO	Throughout operation. Monthly checks.
As new information becomes available with regard to successful mitigation strategies tested, this information must feed into the adaptive management plan.	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks
At operational wind energy facilities where impacts to bats are high, or exceed threshold[4] values, mitigation strategies such as curtailment or deterrents must be used	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks
Social		
Skills development programmes and training should be provided and implemented to maximise the number of employment opportunities for the local communities of Pofadder and Kakamas.	Developer to implement	Throughout operation. Monthly checks
The project proponent together with the Khâi-Ma and Kai !Garib Local Municipalities should explore the option for establishing a Community Development Trust.	Developer to implement	Throughout operation. Monthly checks

[4] MacEwan, K., Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. 2018. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – ed 2. South African Bat Assessment Association.

Mitigation Measure	Responsibility	Timing / Frequency
The project proponent and the local municipalities, together with the Tourism Centre, need to explore the possibility of establishing a visitor centre for the proposed project.	Developer to implement	Post Construction.
The potential opportunities for local content, procurement as well as community shareholding should be explored and maximised.	Developer to implement	Throughout operation. Monthly checks
The potential trustees to sit on a Community Trust need to be identified with the assistance of the Khâi-Ma and Kai !Garib local municipalities. The structure of this trust and the trustees also need to be established to ensure that the Trust is also not mismanaged.	Developer to implement	Throughout operation. Monthly checks
There must be strict financial management controls in place to manage the funds generated for a Community Trust for the proposed Paulputs North WEF. Financial management controls that could be implemented can include annual audits.	Developer to implement	Throughout operation. Monthly checks
There should be a clear criteria for the identification and the funding of community projects, for the local communities to optimally benefit from the trust.	Developer to implement	Throughout operation. Monthly checks
Noise		
The maximum operational noise level from the Development should not exceed 45dB, L_{Aeq} at the closest identified potential noise-sensitive development.	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks
Operational noise monitoring to be undertaken at the closest residential dwelling (H3), within 6 months of the Development being fully commissioned. In the event that the Development is found to exceed the noise limit specified above, the operator should implement a noise abatement programme in consultation with a suitably qualified Acoustics Consultant, and a further measurement undertaken to determine compliance. This cycle should continue until it can be demonstrated that the Development is operating within its specified noise limit.	Developer to implement	Throughout operation. Monthly checks
Visual		
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.	Developer to implement	Pre-Construction / Design Phase
If possible, turbines should be painted plain white, as this is a less industrial colour. Bright colours and logos on the turbines should be kept to a minimum. Where one or more turbine blades are painted in an alternative colour, it is recommended that this colour is restricted to black or grey.	Developer to implement	Pre-Construction / Design Phase

Mitigation Measure	Responsibility	Timing / Frequency
Inoperative turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).	Developer to implement	Throughout operation
If turbines need to be replaced for any reason, they should be replaced with the same model, or one of equal height and scale, where possible. 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).	Developer to implement	Throughout operation
Unless there are water shortages, dust suppression techniques are to be implemented on all access roads.	Developer to implement	Throughout operation
Light fittings for security at night should reflect the light toward the ground and prevent light spill.	Developer to implement	Throughout operation
The operation and maintenance buildings should not be illuminated at night.	Developer to implement	Throughout operation
Where possible, underground cabling should be utilised.	Developer to implement	Pre-Construction / Design Phase
Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter.	Developer to implement	Pre-Construction / Design Phase
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	Developer to implement	Pre-Construction / Design Phase
As far as possible, limit the number of maintenance vehicles, which are allowed to access the sites.	Developer to implement	Throughout operation
Aquatic		
Monitor and improve the stormwater and energy dissipation features to minimise impacts on the hydrological regime from alteration of surface run-off patterns.	Developer / Operator to implement	Throughout operation
Strict use and management of all hazardous materials used on site in line with the specific material safety data sheets, e.g. fuels must be stored within a contained / bunded site with the necessary and spill kits available.	Developer / Operator to implement	Throughout operation
Containment of all contaminated water by means of careful run-off management on the development site	Developer / Operator to implement	Throughout operation

Mitigation Measure	Responsibility	Timing / Frequency
Appropriate ablution facilities should be provided for on-site staff during the operation of the facility	Developer / Operator to implement	Throughout operation
Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities. Any management actions must be dealt with in the Stormwater Management Plan (SWMP) typically submitted post EA, forming part of any WULA.	Developer / Operator to implement	Throughout operation
Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas or have steep embankments	Developer / Operator to implement	Throughout operation
No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.	Developer / Operator to implement	Throughout operation
Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities	Developer / Operator to implement	Throughout operation
All alien plant re-growth must be monitored, and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	Developer / Operator to implement	Throughout operation

8 ALIEN INVASIVE MANAGEMENT PLAN

8.1 Purpose of the Alien Invasive Management Plan

The purpose of the 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 Paulputs Wind Energy Facility North. The broad objectives of the plan include 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 and encroachment;
- Initiate and implement a monitoring and eradication programme for alien and invasive species; and
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

8.2 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.

8.2.1 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.; and

- Construction camps and lay-down areas which are cleared or are active for an extended period.

8.2.1.1 Wetlands, drainage lines and other mesic areas

There are a relatively large number of drainage lines at the site as well as a number of artificial wetlands. 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 must be minimized and these areas must be checked for alien species more than the surrounding landscape.

8.2.1.2 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.

8.2.1.3 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

8.3 General Clearing and Guidance Principles

- Alien control programs are long-term management projects and must include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site must be identified during pre-construction surveys of the development footprint. This may occur simultaneously to other required reaches and surveys. The clearing plan must then form part of the pre-construction reporting requirements for the site.
- The plan must include a map showing the alien density and indicating dominant alien species in each area.
- Lighter infested areas must be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally must 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 must be monitored and documented to keep track of which areas are due for follow-up clearing.

8.4 Clearing Methods

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

https://www.environment.gov.za/sites/default/files/legislations/guideto_clearing_invasive_alienplants.pdf

8.5 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 must 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 must 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 must be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles must be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures must also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the *Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation* guideline must be followed.

9 ALIEN PLANT MANAGEMENT PLAN

9.1 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 must 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 must 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 must not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose must be brought onto site. Brush from cleared areas must 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 must be checked regularly and any weeds emerging from material stockpiles must 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 must adhere to best-practice for the species involved. Such information can be obtained from the DFFE 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 must 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

9.1.1 Monitoring Actions - Construction Phase

The following monitoring actions must 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

9.2 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 must be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified must 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 must take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation must 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, must 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 must be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species must be used.	When necessary

9.2.1 Monitoring Actions - Operational Phase

The following monitoring actions must 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

9.3 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

9.3.1 Monitoring Actions - Decommissioning Phase

The following monitoring and evaluation actions must 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

10 PLANT RESCUE AND PROTECTION PLAN

10.1 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 reusing 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.

10.2 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.

10.3 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.

10.4 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 must commence during early spring after the first rains.

10.5 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.

11 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 EMPRs 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; and
- 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 EMPr-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; and
    - Viable goals of desired outcomes.

Prior to vegetation rehabilitation, all stakeholders involved must 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 must 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.

11.1 Map and create management areas

The entire project area must be mapped and divided into management areas indicating current land cover, including:

- Roads and residential areas;
- Areas with IAPs, subdivided further in sparse or dense infestations where applicable;
- Transformed areas; and
- 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 must 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.

11.2 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 must 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.

11.3 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 an 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.

11.4 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 must preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix must 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.

11.5 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 must be re-introduced, seed must 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 must 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 must resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

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) must be sown or planted.

11.6 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 must 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 these 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.

11.7 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) must 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 at 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 must 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.

12 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 substation and battery energy storage system, 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 substation and battery energy storage system have the potential to impact negatively on the character of the area, as identified in the Visual Impact Assessment conducted during the original EIA undertaken in 2019. The following actions must be implemented to minimise this visual impact:

- Substation complex 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 must 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 must 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 must be strictly controlled;
- All visitors and contractors must be required to sign-in; and
- Signage at the entrance must indicate that disturbance to fauna and flora is strictly prohibited.

The following activities must 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; and
- No interfering with livestock.

12.1 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 must be adhered to:

- A grazing management plan for the site must be developed in cooperation with Agricultural Extension services.
- The stocking rate applied must be within the recommended limits as identified by the Department of Agriculture.
- Livestock must 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 must 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.

13 TRAFFIC MANAGEMENT PLAN

The objective of the Traffic Management Plan is the prevention of incidents (crashes and traffic congestion) during the construction phase, operations and maintenance phase and

decommissioning phase of the proposed WEF. Traffic volumes will increase during the construction phase. Operations, maintenance and decommissioning phase traffic is expected to be insignificant, except where a major WEF component (i.e. replace damaged turbine blade) could be required.

The Traffic Management Plan should include the following:

13.1 Transport of Equipment and Materials

- A comprehensive assessment of the entire route is recommended on award of the project. (The recommended access route is from Saldanha Port towards the N7 near Clanwilliam, and then along the N7 to Springbok where the route follows the N14 through Pofadder to the site).
- Prohibit WEF equipment and materials transportation at night, during the school December holiday period, on public holidays, during festivals or other special events.
- Avoid Abnormal Load vehicle transportation in the towns of Saldanha and Springbok during peak traffic hours, as far as possible.

13.2 Site Access

- It is proposed to take direct access from the N14 via existing farm accesses. The access design must be submitted to SANRAL for approval.
- The construction access points must be stop controlled and widened to allow for exclusive right-turn and left-turn lanes off the N14, which must accommodate the abnormal vehicle turning circles.
- Clear and visible signage must be placed on the N14 and around site, clearly demarcating site entry and exit points.
- Flagmen, speed reduction and stop control on the N14 will be required to accommodate (super-load) abnormal load vehicles entering and leaving the site (in addition to vehicle escort of super-load vehicles).
- Ensure that access is controlled and that access control staff are trained to avoid tailbacks / delay for vehicles entering the site.

13.3 Staff and Worker Transport

- Limit use of private cars by arranging bus transport service for workers.
- Provision must be made on-site on either side of the N14, for public transport/bus parking.
- Where necessary public transport vehicles should allow boarding and alighting, on-site, on both sides of the N14, to prevent staff/workers crossing the N14 to access public transport.
- Provide staff private vehicle parking on-site, on both sides of the N14.
- By design, limit pedestrian/vehicle conflict on-site (i.e. vehicle travelled path and pedestrian walkways).

13.4 Abnormal Load Clearance/Permits

- Clearances will be required for the transport of the Wind Turbine components.
- Applications for Abnormal Load Permits must be submitted to the Department of Transport and Public Works, Eskom and Telkom for approval.
- A WEF Site-specific traffic plan must be developed and implemented during the detailed design phase prior to construction.

13.5 Vehicle and Driver Standards

- Monitor for overloading of vehicles.
- All vehicles must be roadworthy and serviced regularly.

- Use only well trained, suitably qualified and experienced drivers in possession of an appropriate and valid driver's license.
- Require all drivers to abide by standard road and safety procedures on-site.
- Require all drivers to adhere to the speed limits and rules of the road when travelling on public roads.

13.6 Site Management

- Avoid overlapping active work zones (i.e. WEF and GRID construction).
- 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 on site. Monitoring actions to be conducted by the Environmental Control Officer (ECO).
- Maintain incidents / complaints register for community complaints.
- Monitor dust generation and implementation of management actions detailed above.

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, using the guidelines above;
- 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.

14 TRANSPORTATION MANAGEMENT PLAN

The National Road Traffic Act (NRTA) 93 of 1996 and associated regulations prescribe the permissible vehicle dimensions and masses of vehicles travelling on public roads. Where vehicles will exceed these requirements and where the load cannot be dismantled without significant cost / effort, it must be classified as an abnormal load and an exemption must be obtained in terms of section 81 of the NRTA.

Due to the nature and scale of the proposed development, a Transportation Plan is required to effectively manage the transport of the various Wind Turbine Components (abnormal load) on the public road network.

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

14.1 WEF Components

The heaviest component of a wind turbine is the nacelle (approximately 85 tons – depending on manufacturer and design of the unit). Combined with road-based transport, it has a total vehicle mass of approximately 130 ton (for the 85 ton unit). Thus route clearances and permits will be required for transporting the nacelle by road based transport.

The 90 m long blades are the longest component 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 or in pairs, depending on manufacturers transport requirements.

The various Wind Turbine components are considered to be abnormal loads, either by 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.

14.2 Abnormal Load Classification and Permit

During the WEF construction phase, the project will require the use of abnormal load vehicles as stipulated in the TRH 11, for the transportation of turbine components to site. Consequently, an exemption permit for each province that the load has to transit is required. Post-construction, standard transport will be used, except where a significant component might need to be replaced (i.e. damaged blade).

Provision for transport of abnormal loads, such as are required for the WEF, is contained 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 basic 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 damage to the road infrastructure by an abnormal vehicle has to be recovered from the carrier;
- 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.

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

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

14.3 Abnormal Load Transport

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.

- For loads with a height of 4.70m measured from the ground requires 1 x Own Escort vehicle.
- For loads of 5.50m + high Telkom Clearances are required for the lifting of overhead lines.
- For loads of 5.80m + high Eskom Clearances are required for the lifting of overhead lines.
- The "super-load" abnormal load vehicles transporting wind turbine components will require either 2 x Provincial Traffic Escorts or 1 x Provincial Traffic Officer Escort and 1 x Own Escort.

While the N7 and N14 (proposed "N7" access route are generally of high standard and many of the structures have been assessed for load bearing capacity and height clearance in the past), the proposed WEF design (90 m blades) is particularly large and the route clearances will need due assessment. Where required, existing public roads may need to be upgraded and street furniture possible will need to be temporarily moved along the proposed equipment transport route to allow for the transportation and delivery of wind turbine components and other associated infrastructure components.

The turbine supplier/s or the contractor selected for implementation would be responsible for the transportation of wind turbine components to site.

A comprehensive Transportation Plan must be undertaken prior to construction.

The Transportation Plan should include the following:

- Detailed assessment of the preferred "N7" route for transportation of WEF components from Saldanha Port to Site, and identification of alternative routes where necessary.
- Identification of all load clearance issues and determine measures to address such (i.e., determine area for hardstands, temporary relocation of street furniture, impact on trees in vehicle turning circle, temporary closure of kerbside parking, temporary removal of median islands, etc.).
- Determine an effective transport strategy to minimise transportation impact on the road network (i.e. hold super-load / abnormal load vehicles transporting wind turbine blades ahead of a mountain pass, close the mountain pass for a limited period of time to allow abnormal load vehicles to travel in convoy through the mountain pass).
- Submit application for all relevant permits for abnormal loads and route clearances to 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 route immediately prior to WEF construction by carrying out a condition assessment or from recent pavement management system condition assessments, where available from the Provincial Authorities.
- Place public notices regarding any planned abnormal load transports at the construction site to inform affected parties.
- Ensure adequate escort of abnormal load transportation vehicles (this may exceed the TRH11 requirements of 2 x traffic officers).
- Ensure vehicles carrying abnormal loads 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.
- Develop emergency procedures for possible transport incidents en-route to and on-site.
- Do a dry run of the Transportation Plan prior to implementation.
- Create a monitoring / reporting system to ensure compliance with the Transportation Plan and to identify possible issues or incidents in order to facilitate improvements to the TMP.

It is pointed out that the wind turbine specifications and particular transport requirements as well as the proposed site access on the N14 should be addressed in detail in the respective Transportation Plan and Traffic Management Plan.

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

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

15 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 floodline;
- 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; and
- Prevent surface run-off from areas of potential contamination.

16 EROSION MANAGEMENT PLAN

16.1 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.

16.2 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.

16.3 Background

16.3.1 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.

16.3.2 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.

16.3.3 Erosion and Sediment Control Principles

The goals of erosion and sediment control during and after construction at the site must 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; and
- 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.

16.3.4 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 must be closely linked to one another and must not operate independently, but must rather be seen as complementary activities within the broader environmental management of the site and must 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 must 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 must be minimized. Allied to this the fact that topsoil does not store well and must 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 must not be cleared at a time, especially in areas such as slopes where the risk of erosion is higher.

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

16.5 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 must 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.

16.5.1 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 must apply.

- Adequate culverts must be provided along the length of all roads to prevent diversion of flow from natural drainage lines.
- Culverts must be carefully located, such that outlet areas do in fact align with drainage lines.
- The downstream velocity of runoff must be managed, such that it does not result in downstream erosion – on steep slopes, where roads have been constructed on cut areas, allowance must 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 must 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 must 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.

16.6 Monitoring Requirements

16.6.1 Construction Phase

The following monitoring actions must 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

16.6.2 Operational Phase

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

Monitoring Action	Indicator	Timeframe
Monitor for the development of new erosion problems across the	Map of erosion problem areas	Quarterly

site, with a focus on areas where water has been diverted or collected from upslope onto downslope areas		
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

17 FIRE MANAGEMENT PLAN

The National Veld and Forest Fires Act, Act No. 101 of 1998, as amended, 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 through the facility
- Personnel within the facility
- Infrastructure such as transmission lines

17.1.1 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 must 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 m to 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 must be implemented.

18 BESS RISK ASSESSMENT AND MANAGEMENT PLAN

18.1 High-Level BESS Risk Assessment

The main concerns relating to a BESS are fire hazards (from toxic and flammable gasses) and the potential for a condition known as '*thermal runaway*'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. As far as general environmental risks, the main concerns are surrounding the disposal of the batteries at end of their life.

This section will attempt to address the risks associated with onsite use of battery energy storage systems (BESS) for the Paulputs North WEF, and the resultant Risk Assessment is presented in Table 18.1 below. To do this, the EAP looked at several potential situations which could result in a possible detrimental environmental hazard. These are:

1. The actual risks associated with the delivery, connection, operation, maintenance, disconnection and disposal of the batteries.
2. The likelihood of these actual risks occurring.
3. The significance of the impacts should these risks take place.
4. Appropriate and practical mitigation measures and/or management actions to reduce likelihood of the risk occurring and/or the impact.

A comprehensive operations and maintenance programme is necessary to ensure that all management and mitigation measured are included in the EMPr and adopted and implemented as well as to ensure that all monitoring and protective devices are in good working order.

Regular inspections should be undertaken to ensure the battery systems are not overheating or showing signs of malfunction. Annual thermographic scanning can help ensure the BESS is operating within normal parameters.

Where a BESS does not meet its performance requirements, and where repairs do not solve a problem which exists, and where change in the BESS does not lead to a profitable alternative business solution, the BESS is said to have reached its End-of-Life (EoL). Following an EoL shutdown procedure a BESS would be de-installed, disassembled, removed from the site and transported. Further, its components would be reused and/or recycled.

For decommissioning the energy storage system, the appropriate technical guidelines from the manufacturer should be consulted. Before the actual decommissioning, the BESS system needs to be checked for hazardous substances and a risk assessment should be performed considering safety and/or environmental risks which might occur during the decommissioning activities (e.g., fire hazards, electric shocks and poisonous effects on the environment). Depending on the safety and/or environmental risks identified and on the type of BESS equipment, local authorities should be consulted or informed about the decommissioning activities.

For recycling, it is advised to consult a specialized organization in waste treatment to the extent that all materials, also non-hazardous are disposed of correctly and preferably recycled. Several materials which commonly are found in modern batteries or redox flow batteries are environmentally hazardous and regulated and thus should be disposed of according to regional government requirements, such as directive 2006/66/EC of the European parliament and of the council, also known as the Batteries Directive.

This high-level risk assessment must be replaced with a detailed technology specific risk assessment once the final equipment suppliers have been identified during the detailed design and procurement stage.

As read within the EMPr, various recommendations have been made. These include:

- Training of all staff and employees on how to handle spillages, fires and electrocutions with regards to the BESS.
- Bunding of BESS containers during construction
- Implementation of spill handling and management, compiled specifically for the BESS.
- MSDS Records to be kept, as well as incidents reporting register to record any incidents relating to the BESS.

In terms of the BESS, the following mitigation measures are necessary regarding the workshop, equipment, maintenance and storage of the BESS during construction:

- Regular inspection of containment/ bunding.
- Risk assessment to be conducted.
- Appropriate supervision.
- Adhere to handling and storage instructions.

- Site clean-up and rehabilitation response procedure.
- Use of suitable equipment.
- Equipment properly packaged/ bunded in line with regulations.
- Ensure that storage facilities meet OEM requirements.
- Specialist staff trained and accredited to appropriate standard
- Including redundancy in the design of the BESS to provide multiple layers of protection;
- Designing the BESS and substation yard to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS.

The applicant must compile and implement the following additional programs to be submitted to the Competent Authority prior to the commencement of installation of the BESS:

- Tactical Fire Response Plan;
- Lifecycle Battery Recycling programme; and
- First Responder Training manual

As mentioned above, a risk assessment is to be undertaken. The applicant must compile and implement the following additional programs to be submitted alongside the risk assessment to the Competent Authority prior to the operation of the BESS:

- Thermal management and monitoring programme; and
- BESS operations and maintenance programme

It is recommended by the EAP that the management objectives for the BESS by reassessed once the preferred BESS technology has been determined. The Applicant would be required to send a Management Plan for the particular technology to the Competent Authority for approval.

Table 18.1 High-Level BESS Risk Assessment

Possible Risk	Resultant Impact Significance	Likelihood of occurrence	Management / Mitigation
Spillages Thermal Runaway Poor Maintenance	- Electrocution - Potential spillage of electrolytes or refrigerant - Vented gasses - Staff and personal injury - Contaminated Runoff - Soil and microbe contamination - Groundwater seepage - Downstream effects on the current terrestrial ecosystem.	Low	- Training of all staff and employees on how to handle spillages, fires and electrocutions - Records kept for well managed operations and maintenance. - Bunding of containers - Implementation of spill handling and management in line with the generic EMPr - Demarcate all no-go and sensitive areas - Avoid the placement of batteries near watercourses and sensitive features - MSDS Records to be kept, as well as incidents reporting register. - Source batteries from reputable suppliers - Battery inspection prior to installation. - Maintenance. - Appropriate battery design and venting control - Source from reputable manufacturers. - Safe and appropriate storage in line with the above and the generic EMPr. Safe handling which must include battery inspection prior to installation. - Development and implementation of Thermal Management Plan prior to installation/construction.
Fire Risk	- On-Site Fire - Fire Spread - Staff and personal injury	Medium	- Procuring components and using construction techniques which comply with all relevant legislation; - Including automatic fire detection systems in the development design; - Including automatic fire suppression systems in the development design; - Including redundancy in the design of the BESS to provide multiple layers of protection; - Designing the BESS and substation yard to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS; and - Ensuring that Staff appointed to work within the BESS and substation area, as well as First Responders receive adequate emergency response training to a fire. - Work with first responders and relevant Personnel to develop a Tactical Fire Response Plan in case of an incident

Inappropriate Storage	- On site fires. - Electrical failure - Electrocution - Potential spillage of electrolytes or refrigerant - Vented gasses - Staff and personal injury - Contaminated Runoff - Soil and microbe contamination - Groundwater seepage - Downstream effects on the current terrestrial ecosystem.	Low	- Training of all staff and employees on how to handle spillages, fires and electrocutions - Records kept for well managed operations and maintenance. - Bunding of containers - Implementation of spill handling and management in line with the generic EMPr - Demarcate all no-go and sensitive areas - Avoid the placement of batteries near watercourses and sensitive features - MSDS Records to be kept, as well as incidents reporting register. - Source batteries from reputable suppliers - Battery inspection prior to installation.
Limited Employee Training and Experience	- Time lag for first respondent - Inability to contain spillage - Fire - Electrocution - Damage to exiting/surrounding infrastructure	Low	- During the construction phase of Paulputs North WEF, first responders from the nearest major center (such as fire fighters and paramedics) must be given appropriate training on dealing with any emergency situation that may occur as a result of the BESS. Such training must be provided by the technology suppliers or an appointed service provider.
Inappropriate disposal at the end of life	- Potential scenario of fluids from the batteries leaking into environment. The release of such chemicals through leaching, spills or air emissions can harm communities, ecosystems and food production. - The potentially toxic materials contained in batteries means that they are classified as hazardous materials in terms of NEM:WA. There are only a few licensed hazardous waste sites in South Africa and recycling of batteries and e-waste has been identified as a sure way of improving the lifespans of such sites.	Medium	- The recycling of batteries and their potential use as e-waste. - Disposal at a licensed hazardous waste site. - Prior to construction of the Paulputs North WEF, the Applicant is to develop a dedicated Battery Recycling Programme to be adopted on-site. - Records of disposal at a licensed facility must be kept.

19 FUEL STORAGE MEASURES

19.1 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.

19.2 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 must ensure that process equipment, controls, and procedures are designed, installed and maintained to safely operate the process.
- All employees must understand the chemical and process hazards.
- Facilities must 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".
	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

20 AVIFAUNA MONITORING AND MANAGEMENT PLAN

20.1 Construction Phase Bird Monitoring Programme

Construction phase bird monitoring must be conducted in line with the current best practise guidelines[5] and applicable species specific guidelines (i.e. Verreaux's Eagle guidelines[6]). Construction phase bird monitoring must be conducted throughout the entire construction phase of the WEF.

For the purposes of compiling this programme it assumed that the length of the construction phase will be 12 months, and hence this programme is based on a 12 month period. The length (and scope) of the programme must be revised once the construction schedule has been finalised, and any additional pre-construction bird monitoring has been completed.

Construction phase monitoring must be conducted by an avifaunal specialist, and an Environmental Control Officer (ECO) must oversee activities and ensure that the site specific EMPR is implemented and enforced.

20.1.1 General Construction Phase Mitigation Requirements

- Construction activities must be conducted to reduce unnecessary destruction of habitat;
- High traffic areas and buildings such as offices, batching plants, storage areas etc. must where possible be situated in areas that are already disturbed and existing roads and farm tracks must be used where possible;
- The minimum footprint areas of infrastructure must be used wherever possible, including road widths and lengths;
- No turbines must be constructed in no-go areas, while associated infrastructure must be avoided where possible in these areas;
- Any clearing of trees (>3 m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site must be approved first by an avifaunal specialist. Before, clearing, the location and description of the trees must be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing;
- The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests.
- 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 (e.g. in Toolbox talks) 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 avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and
- 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 specialist.

20.1.2 Avifaunal Walkthrough

- Prior to construction, an avifaunal specialist must conduct a site walkthrough, covering the final infrastructure layout and final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which

[5] Birds and Wind-Energy Best-Practice Guidelines. Third Edition, 2015 (Jenkins et al. 2015).

[6] Verreauxs' Eagle and Wind Farms-Guidelines for impact assessment, monitoring and mitigation. BirdLife SA, 2017.

construction activities may need to be excluded, particularly at certain times (e.g. breeding season).
- Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species.
- Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who must advise on an appropriate buffer, within which construction activities may not occur during key breeding times.

20.1.3 Construction Phase Nest Surveys

- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date (and particularly the Martial Eagle nest 12 km west of the site and the Verreaux's Eagle nest south of the site). This monitoring must be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.

20.1.4 Reporting

- An avifaunal specialist must confirm the reporting requirements, but these must be in line with guideline requirements and reports must be submitted to relevant stakeholders in line with applicable guidelines. At least two construction phase bird monitoring reports should be produced per year.

20.2 Operational Phase Bird Monitoring Plan

The aim of the operational phase monitoring will be to determine the actual impacts of the WEF on avifauna. These impacts can then be assessed against observed activity of birds on site during the same time (and associated environmental conditions) that the impacts were realised. Operational monitoring is therefore critical to:

1. Determine the actual impacts of the WEF;
2. Determine if additional mitigation is required (adaptive management); and
3. Improve future assessments

20.2.1 General

Operational phase (i.e. post-construction) bird monitoring at the Paulputs North WEF must commence once all turbines have been erected and the blades are turning. This may be during the commissioning phase, prior to the commercial operation date of the facility. An avifaunal specialist must be appointed to design the site specific monitoring methodology (e.g. exact survey locations, sampling frequencies and sampling times etc.) and to implement the monitoring plan.

Monitoring must be done in line with the latest best practise guidelines applicable at the time of monitoring commencing. Operational monitoring must have two components: Bird Activity Monitoring (BAM) and Carcass Searches (CS). In the first year, BAM and CS must run concurrently, and reporting must be combined where possible, allowing for the results of fatality monitoring to be interpreted against the results of the bird activity on the site over the same time period. The results of this monitoring and the carcass searchers in year one should advise the need for any additional ongoing activity monitoring or nest surveys beyond the first year month period. CS monitoring must continue regardless for the second and third year of operations, and then as a minimum must be conducted again in years 5, 10, 15, 20 and 25 of the facility.

Reports must be generated as part of operational monitoring programme and must be submitted to Birdlife SA, Endangered Wildlife Trust (EWT), Department of Forestry, Fisheries and Environment (DFFE) and the relevant provincial environmental department/authority.

20.2.2 Bird Activity Monitoring

- Bird Activity Monitoring (BAM) must repeat the survey protocols used in pre-construction monitoring (amended where these are outdated, to be more in line with current best practise for pre-construction monitoring), over at least the first one year of operations.
- BAM must be conducted over at least four separate seasonal site surveys per 12 month period.
- BAM must include Vantage Point (VP) Surveys, from the same VP locations used during pre-construction monitoring (where possible), over at least 12 hours per VP per season.
- BAM must also include transect (walked and driven) surveys, incidental observations, and surveys of relevant focal sites including nest sites.

20.2.3 Carcass Searches

- Carcass Searches (CS) must be done for the first three years of operations. The need for further fatality monitoring (i.e. carcass searching) should then be reviewed, but at a minimum it must happen in year 5, 10, 15, 20, 25 etc. (i.e. every 5 years).
- Regular CS must cover 75% of all turbines or a minimum of 20 turbines. The turbine search interval should be determined by a specialist, in line with recorded scavenger rates at the site, but as minimum each turbine (selected for regular CS) must be searched every 7 days. Turbines not selected for regular CS, must be searched at least once per month.
- As a minimum, the radius of the search area below each turbine should be equal to 75 % of the turbine height (ground to vertical blade tip).
- In order to determine the probability of an observer detecting a carcass, a total of four searcher efficiency trials (i.e. one per season) must be conducted each year. Trials should be conducted for each individual or search pair, under the supervision of the avifaunal specialist.
- The rate of removal/decay of carcasses should be estimated by conducting scavenger removal trials (four sets of trials per year). Fresh carcasses (where possible) of birds of similar size (and species where possible) to the priority species on the site must be used where possible.
- Reporting should include fatality estimation based on the results of the scavenger and efficiency trials, and the actual number of fatalities recorded by the searchers.
- CS must also be conducted under any met masts on a monthly basis.

20.2.4 Programme Revision

The above programme is based on current best practise and knowledge. At the time of commencement of the WEF operations, this programme must be reviewed by a bird specialist for relevance, and updated if/where required.

21 BAT MANAGEMENT AND CURTAILMENT PLAN

21.1 Bat Management Plan

21.1.1 Construction and Decommissioning Management Plan

Based on the opinion of the bat specialist hydrological features such as wetlands, rivers and farm dams must be buffered by 200 m while drainage lines can be buffered by 100 m. Potential roosts such as rocky crevices, trees and buildings can be buffered by 200 m. No

parts of the turbines, including the blade tips, should enter these buffers. These buffer distances are also dependant on the size of the turbine being used. For example, if the turbine blades sweep close to ground level, the turbine base would need to be moved further from the buffer edge.

Decommissioning activities should be restricted to daylight hours to have negligible impacts to bats.

21.1.2 Operational Management Plan

- Design the layout of the project to avoid areas that are more frequently used by bats. These areas include key microhabitats such as water features, large mature trees, buildings, and rocky crevices. There are currently no turbines located within buffer zones. There are no turbines. All buffers are to blade tip.
- The shortest blade length/rotor diameter should be used to maximize the height of lower blade tip.
- Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e., such as on turbines) and at ground level. Operational monitoring study must commence as soon as turbines are operational.
- Apply blade feathering to prevent unnecessary free-wheeling of blades below generation cut-in speed at operation commencement.
- Apply curtailment based on bat fatality and acoustic monitoring data analysed by the appropriate specialist if mortality occurs beyond threshold levels as determined based on applicable guidance (MacEwan et al. 2018).
- At operational wind energy facilities where impacts to bats are high, or exceed threshold values, mitigation strategies such as blade feathering, curtailment or deterrents must be used, the appointed operational bat specialist must, based on the operational monitoring results determine the use of curtailment.
- The operation of lights at substations should be limited to avoid attracting bats to the area. Where lights need to be used such as at the substation and switching station and elsewhere, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights (Rydell 1992; Stone 2012). High pressure sodium and white mercury lighting is attractive to insects (Blake et al. 1994; Rydell 1992; Svensson & Rydell 1998) and should not be used as far as possible.
- Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane should be restricted and directed to minimise light trespass and sky glow.
- Increasing the spacing between lights, and the height of light units can reduce the intensity and volume of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between and over lights.

We encourage the developers to release the results of the annual monitoring to the South African Bat Assessment Association (SABAA) such that South Africa-wide fatality and displacement results can be collated and assessed. Only in this way will the cumulative impacts assessments, currently crudely estimated, be refined, region by region. Furthermore, if any dead bat species cannot be properly identified by sending them to Dr Leigh Richards (Leigh.Richards@durban.gov.za) at the Durban Natural Science Museum for curation.

21.2 Bat Curtailment Plan

Curtailment, which involves limiting the amount of time turbine blades spin, is the most effective way to reduce residual impacts to bats whereas deterrent technology is still in

testing stages and its effect on reducing bat fatality less known. A curtailment regime can be developed by examining the relationship between bats and meteorological conditions such as wind speed, temperature and humidity. For example, bat activity is typically supressed at higher wind speeds and increases with temperature. This information can be used to develop a curtailment schedule that can be applied when bat activity is high so that potential encounters by bats with wind turbine blades can be reduced. Meteorological data from the mast on site was used for this purpose.

Bat activity was highest in February, August and October and there may therefore be greater residual impacts to bats in these months. Therefore, the relationship between meteorological conditions and bat activity was investigated in these months as they are the periods in which curtailment should be applied. Based on our analysis, curtailment should be applied during specific time periods and under specific meteorological conditions (Table 20-1) when bat fatality threshold are exceeded. For example, in February curtailment should be applied between four and five hours after sunset when the temperature is between 11 °C and 27 °C, or wind speed is between 4 ms^{-1} and 11 ms^{-1}, or relative humidity is between 20 % and 40 % if fatality threshold were exceeded. This curtailment plan is based on only one year of bat activity and must be updated based on additional data collected the operational phase of the development. The plan should be continuously refined and adapted based on incoming bat fatality data.

Table 21-1: Curtailment Parameters for the Paulputs North WEF

	February	August	October
Time Period	Between 4 and 5 hours after sunset	1 hour after sunset	Between 4 and 5 hours after sunset
Temperature (°C)	11 – 27	10 – 27	16 – 27
Wind Speed (ms^{-1})	4 – 11	4 – 13	5 – 13
Relative Humidity (%)	20 – 40	5 – 25	10 – 30

22 QUIVER TREE MONITORING PROGRAMME

Perhaps the plant species of greatest potential concern at the site is *Aloidendron dichotomum*. Although it is likely that individuals of this species can be avoided at the preconstruction stage, a greater long-term threat is likely to be illegal harvesting of young individuals associated with the greater access to the site resulting from the wind farm development. In order to limit, prevent and address any potential decline in this species, a long-term monitoring programme should be developed and initiated before construction. The programme should, at minimum, include the following parameters and activities:

- Size and GPS location of all *Aloidendron dichotomum* plants found on site. Photographs of all individuals present is also recommended for documentation purposes.
- Annual monitoring of size-class structure, including any new deaths, disappearances, and seedlings that have appeared.
- If any seedlings and young plants disappear, then the local populations should be supplemented with seedlings cultured from seed collected on-site.
- There should be signage present at all entrances to the site warning against the illegal collection of any fauna and flora.

The long-term *Aloidendron dichotomum* population monitoring programme must be submitted to Directorate and Department of Environment and Nature Conservation (DENC) for review and approval prior to implementation.

It is important to note that a permit from DALRRD would be required for any impacts on nationally protected tree species, while a permit from DENC would also be required for general clearing and any clearing or removal of provincially protected species. These

permits would be informed by a preconstruction walk-through of the final development footprint.

23 CHANCE FIND FOSSIL PROCEDURE

Should fossils be found on site during the construction phase the following procedure much be followed and a palaeontologist called to site.

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: Paulputs North WEF and associated infrastructure near Pofadder, Northern Cape Province</td></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape, Kenhardt Magisterial District</td></tr>
<tr><td>Responsible Heritage Resources Authority</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Late Caenozoic alluvium along water courses</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Bones, teeth and horn cores of mammals, freshwater molluscs, petrified wood, calcretised termitaria and other trace fossils</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
Context – describe position of fossils within stratigraphy (rock layering), depth below surface
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.</td></tr>
</table>

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.

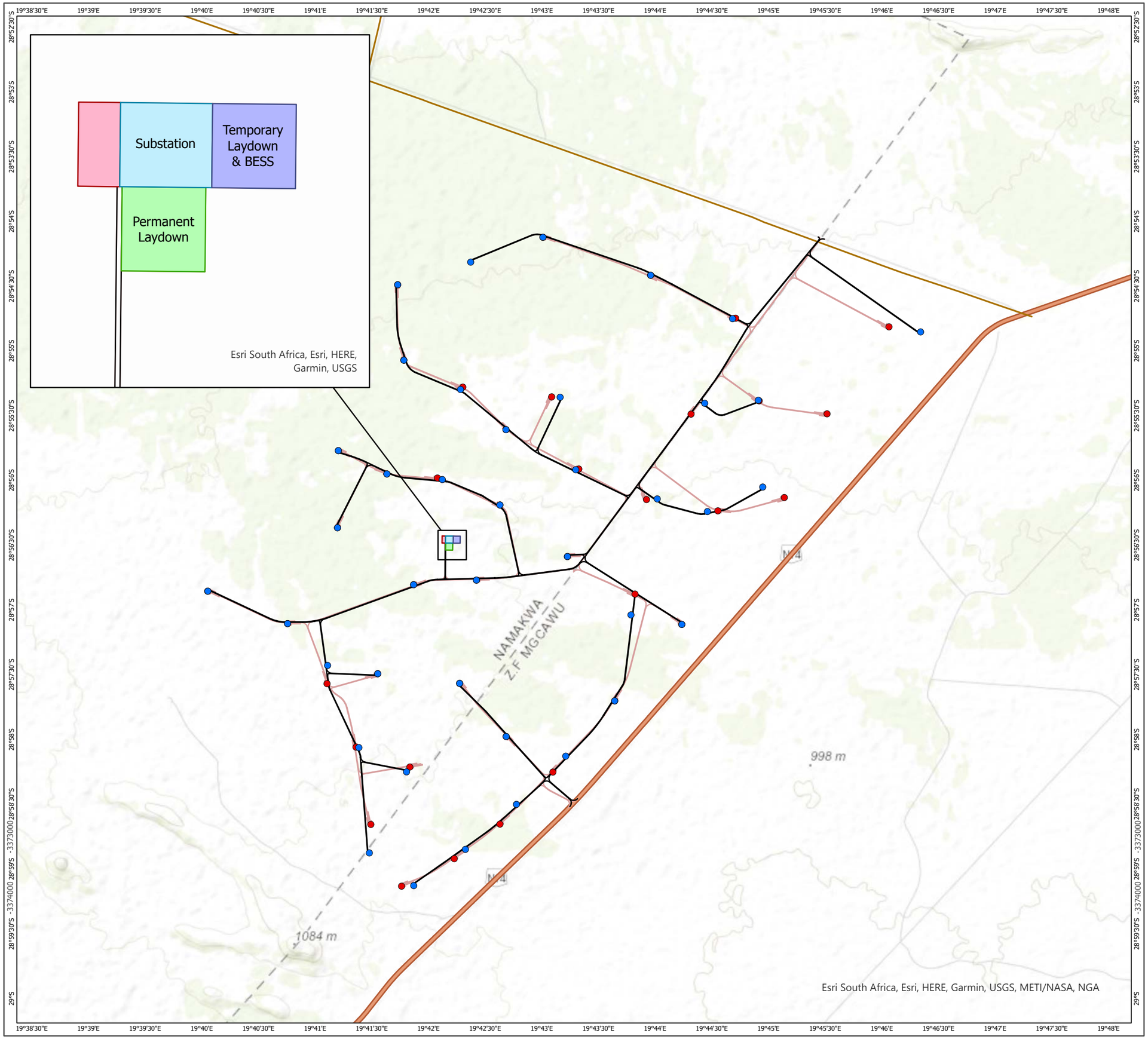
25 CONCLUSION

In terms of the National Environmental Management Act, 1998 (Act No. 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 environmental management is well implemented, and a set of operational guidelines are developed by the long term site management body.

FIGURES



ARCUS

- Paulputs North WTG
- Approved PWEF WTG
- Paulputs North Internal Roads
- Approved PWEF Hardstandings, Roads and Substation
- Office Laydown
- Permanent Laydown
- Substation
- Temporary Laydown & BESS
- N14 Highway
- R358
- Unclassified Road

1:60,000 Scale @ A3

0 1 2 km

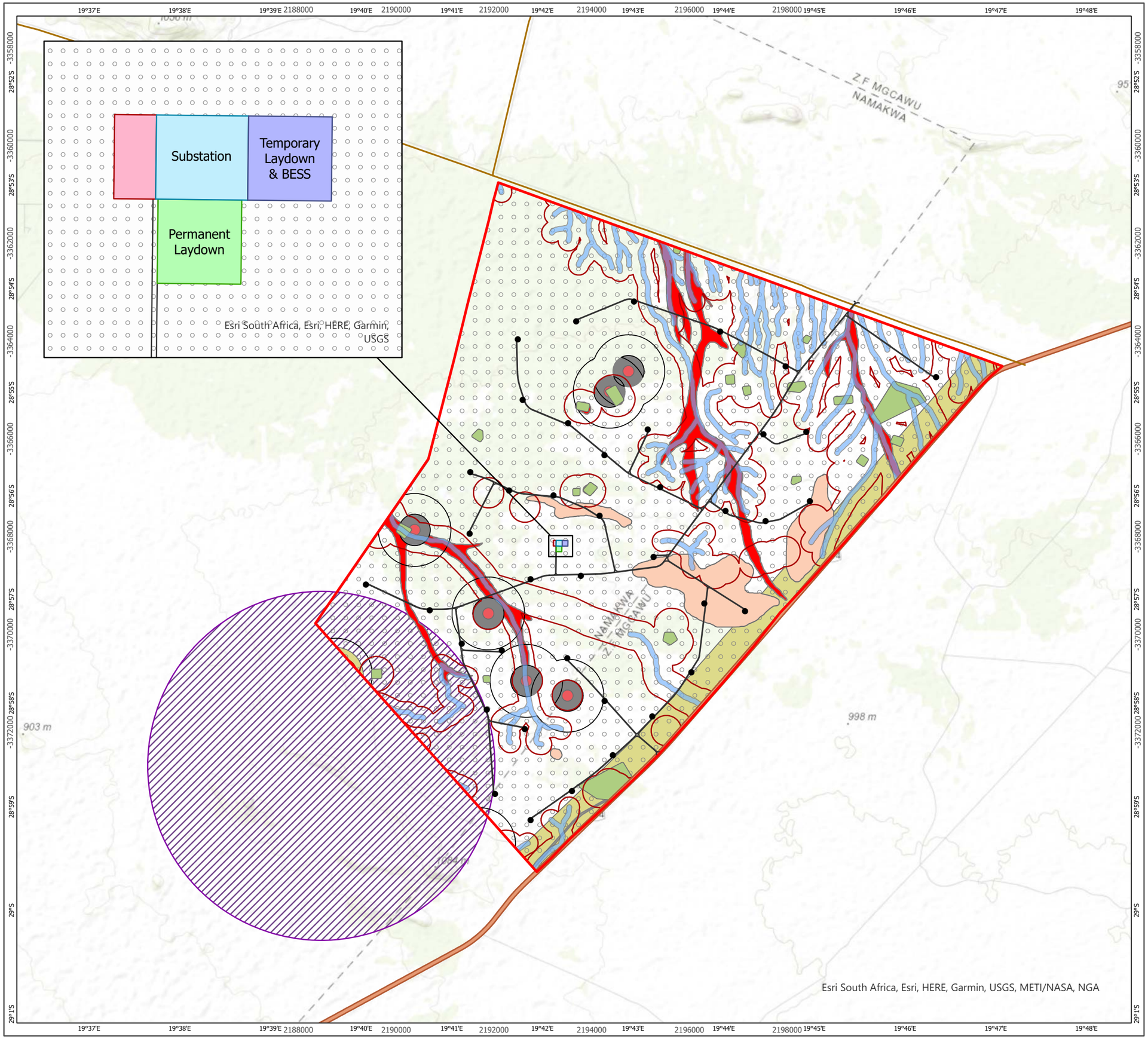
NORTH

Produced By: SC	Ref: 3944-GIS-040
Checked By: AA	Date: 02/11/2021

Proposed Amendment Layout
Figure 1

Paulputs North WEF Amendment EMPr

\\10.0.0.190\share\Administration\GIS Administration\South Africa\3944 Paulputs Amendment Reports\3944 Paulputs Amendment Reports.aprx\3944-GIS-040 Fig01 Proposed Amendment Layout



ARCUS

Paulputs North WEF

- Paulputs North WEF Site
- Amended WTG Layout
- Amended Internal Roads
- Office Laydown
- Permanent Laydown
- Substation
- Temporary Laydown & BESS

Eskom Infrastructure

- Eskom Paulputs Substation
- Existing Eskom Transmission Lines
- Planned Eskom Transmission Lines
- N14 Highway
- R358
- Unclassified Road

Paulputs North Site Sensitivity

- Drainage Buffer 45m
- Bat Buffer 110m Blade
- Heritage Sensitivity Medium
- Noise Sensitivity High
- Noise Sensitivity Medium
- Noise - No Go
- Ecological Sensitivity High
- Ecological Sensitivity Low
- Ecological Sensitivity Medium
- Visual Sensitivity High
- Avifauna Buffer 110m Blade

1:75,000 Scale @ A3

0 1.5 3 km

NORTH

Produced By: SC	Ref: 3944-GIS-041
Checked By: AA	Date: 02/11/2021

Environmental Sensitivity Map
Figure 2

Paulputs North WEF Amendment EMPr

\\10.0.0.190\share\Administration\GIS Administration\South Africa\3944 Paulputs Amendment Reports\3944 Paulputs Amendment Reports.aprx\3944-GIS-041 Fig02 Environmental Sensitivity Map

APPENDIX A - CURRICULUM VITAE OF THE EAP

CURRICULUM VITAE

Ashlin Bodasing

Technical Director and Environmental Assessment Practitioner

Email: ashlinb@arcusconsulting.co.za Tel: +27 (0) 21 412 1529

Specialisms

- Environmental Impact Assessments
- Environmental Management Plans
- Environmental Feasibility Studies
- Environmental Due Diligence and Compliance
- Client Relationship Management

Summary of Experience

Ashlin Bodasing is a Technical Director at Arcus Consultancy Services South Africa (Pty) Ltd. She manages the Arcus South African office and the team based in Cape Town.
Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over fourteen years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

Professional History

2017 – Present	-	Technical Director, Arcus Consultancy Services SA (Pty) Ltd
2015 – 2017	-	Team Leader, Arcus Consultancy Services SA (Pty) Ltd Lead Environmental Officer, Tweefontein Optimisation Project,
2012 – 2015	-	Glencore / Xstrata Coal Mine, Witbank, Mpumalanga, South Africa (*Secondment*)
2007 – 2015	-	Senior Environmental Assessment Practitioner, Parsons Brinckerhoff Africa
2005 – 2007	-	Environmental Consultant, WSP Environment and Energy

Ashlin spent over 2 years at the Glencore (previously Xstrata Coal SA) – Tweefontein Optimisation Project, as the sole environmental officer permanently on site overseeing all their construction projects, ensuring contractor compliance to EMP and Environmental Authorisations. This included the construction of the internal and external infrastructure packages. Roles include ensuring all construction and development are in line with the EIA and EMP for the project. Areas of responsibility include the Mine Infrastructure Area, the Explosives Magazine Area, construction of a secondary school, construction of residential houses, and the rail load out facility. Role also included review of environmental impact assessment applications and reports submitted to the department of environmental affairs for the project.

Qualifications and Professional Interests

- **University of Kwa-Zulu Natal, 2004**
  Bachelor of Social Science (Geography and Environmental Management)
- **Environmental Assessment Practitioners Association of South Africa, 2020**
  Registered Environmental Assessment Practitioner: Number 2020/780

CURRICULUM VITAE

Project Experience

Environmental Impact Assessments

- **Highlands North, South and Central Wind Energy Facilities, 2018-present**. Project Director (client liaison) and Lead EAP.
- **Paulputs Wind Energy Facility, 2018-present.** Project Director (client liaison) and Lead EAP.
- **San Kraal Wind Energy Facility, 2016- 2018**. Project Director (client liaison) and Lead EAP.
- **Phezukomoya Wind Energy Facility, 2016 – 2018**. Project Director (client liaison) and Lead EAP.
- **Kolkies and Karee Wind Energy Facilities, 2016-2016**. Project Director (Client liaison) and Lead EAP.
- **Komsberg East and West Wind Energy Facilities 2015-2016**. Project Director (Client Liaison) and EAP.
- **Umsinde Emoyeni Wind Energy Facilities, 2015-2018.** Project Director (Client Liaison) and EAP.

Ecological Impact Assessments and Monitoring

- **Confidential Wind Farm, 2017-2018, Northern Cape Province**. Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Paulputs Wind Energy Facility 2017-present, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Highlands Wind Energy Facilities 2017 – 2018, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Komsberg Wind Farms, 2015-2016.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Kolkies and Karee Wind Energy Facilities 2015-2016.** Project Director (Client Liaison), coordination and management of bird and bat specialists and review of technical and impact assessment reports.
- **Umsinde Wind Energy Facilities, Additional Bird Monitoring**. Project Director. Coordination and management of bird specialists and review of technical reports.
- **Kap Vley Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Highlands Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Hopefield Wind Farm –Operational Monitoring.** Project Manager. Coordination and management of bird and bat specialists, review of technical reports.
- **Gouda Wind Farm – Operation Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.

Feasibility Studies and Due Diligence Reviews

- **Ecological due diligence for IFC PS6 – Wind Energy Developments:** Project Manager. Review and reporting on bird and bat specialist reports to IFC/World Bank Standards – Various sites across South Africa.
- **Power Plant – Ghana**. Project Manager Compilation of environmental due diligence for refinancing, IFC and World Bank Standards, on behalf of Botswana Development Corporation.
- **Ecological Feasibility Study.** Project Director. Review of the feasibility of a site for a wind energy facility in relation to bats.

- **Environmental Feasibility Study.** Project Director and EAP. Review of a proposed site for the development of industrial facility.

Previous Project Experience

Environmental Scoping and Impact Assessments and Project Management for:

- eThekwini Municipality
- Moreland Developments
- RBCH – Bulk Materials and Handling Facility
- SAPREF
- Mittal Steel Permit Amendment
- Transnet Projects
- ArcelorMittal South Africa
- MCA-Lesotho
- Talbot Group Holdings (Australian Mining Company)
- Ncondezi Energy – Mozambique

Environmental Management Plans and Compliance Monitoring

- Nongoma Road Monitoring – Compliance Monitoring
- eThekwini Municipality - Taxi Holding Areas: Canberra Road and Umgeni Road Compilation of the EMP; and Bi-monthly compliance monitoring (site visits) and reporting.
- EMP for Kwezi V3 - Kwamashu Fuel Tank Exemption
- eThekwini Municipality - Ridgeview Road – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Phoenix Overhead Transmission Lines – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - E8546 E8699 Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Environmental Assessment and EMP
- EMP for eThekwini Municipality - Parlock Switching Station

Training and Auditing

- Petronet Alien Plant Training - Compilation of the training material for alien plant identification and removal methods.
- eThekwini Municipality - Taxi Holding Areas – Canberra and Umgeni Road - Contactor and workforce training.
- eThekwini Municipality - Kingsway Road Taxi Rank - Contactor and workforce training.

Environmental Reviews / Terms of Reference

- Biotherm Energy - Environmental Project Manager: Independent review of environmental impact assessment reports and management plans compiled for 3 wind farms in the Western Cape and 2 PV Solar Plants in the Northern Cape, to ensure compliance to IFC and World Bank Standards.
- Government of Zimbabwe – Hwange Power Station - Environmental Project Manager: Compilation of the Terms of Reference for Environmental Management Plan and Environmental and Social Audit of the Hwange Power Plant in Zimbabwe.

Pre-Feasibility Studies

- Pre-feasibility studies for eThekwini Municipalit, Investec, Sekoko Coal Resources, Mulilo, Sekoko Mining and MCA-Lesotho for renewable energy, coal mines and power plants.