# PROPOSED GREAT KAROO WIND FARM, NORTHERN CAPE PROVINCE

## CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

**Revision 1**
**July 2019**

**Prepared for**
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## PROJECT DETAILS

| | | |
|---|---|---|
| **DEA Reference No.** | : | 12/12/20/2370/3 |
| **Title** | : | Environmental Impact Assessment Process<br>Environmental Management Programme: Proposed Soetwater Wind Farm (Phase 3 of the Hidden Valley Wind Energy Facility), Northern Cape Province |
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| **Client** | : | Great Karoo Wind Farm (Pty) Ltd |
| **Report Status** | : | Revision 1 EMPr submitted as part of the Part II amendment for the Great Karoo WEF, July 2019 |
| **Revision** | : | 1 |

**When used as a reference this report should be cited as:** Savannah Environmental (2019) Environmental Management Programme: Revision 1 - Proposed Great Karoo Wind Farm, Northern Cape Province

# DEFINITIONS AND TERMINOLOGY

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

**Ambient sound level**: means the background noise level already present in the environment (in the absence of noise generated by any other proposed development)

**Commence:** The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

**Commercial Operation date:** The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

**Commissioning:** Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the power station are installed.

**Construction:** Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

**Cumulative impacts:** Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

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

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

**Decommissioning:** To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

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

**Disturbing noise**: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more. A disturbing noise would be a noise that increase the rating level with more than 7 dBA. Therefore, for this area the rating level is 35 dBA, and if the operation of the wind energy facility results in a noise level higher than 42 dBA, and that change can be attributed to the wind energy facility that would be a disturbing noise.

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

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

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

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

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

**Environmental assessment practitioner:** An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

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

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

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

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

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

**Hazardous waste:** Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010; pg 185).

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

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

**Indirect impacts:** Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

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

**Method statement:** method statement is a written submission to the ECO and the Owner's Representative by the EPC Contractor in collaboration with his/her EO.

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

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

**Perennial and non-perennial**: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

**Pollution:** A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

**Pre-construction:** The period prior to the commencement of construction, which may include activities (e.g. geotechnical surveys) which do not require Environmental Authorisation.

**Ramsar Convention on Wetlands:** "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International

Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

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

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

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

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

**Tower:** The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 – 120 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 120 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

**Waste:**

(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or
(b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste—

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;
(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;
(iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

**Watercourse:** as per the National Water Act means -
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

**Wetland:** Wetlands are defined in the National Water Act as 'land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

» **Intermittent or seasonal wetlands:** are vleis or larger drainage lines where water tends to accumulate during the rainy season, and may persist for a week or longer, usually several months. In this case there is enough seasonal moisture accumulation to ensure that surface soils remain waterlogged for a longer period, hence also supporting specially adapted flora that will grow in (seasonally) saturated soils.
» **Perennial[1] wetlands:** are all dams, rivers and other water bodies that carry water permanently, and will only have severely reduced flows or water during periods of prolonged severe droughts.

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

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

[1] Perennial: from Latin per, "through", annus, "year", lasting or active through the year or through many years, indefinitely.

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# CHAPTER 1: PURPOSE & OBJECTIVES OF THE EMPR

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"[2]. The objective of this Environmental Management Programme is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to help ensure compliance with recommendations and conditions specified through an EIA process, as well as to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed wind energy facility), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation for use of the EMPr by the project implementer as well as compliance monitors).

The EMPr has the following objectives:

- To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the wind energy facility.
- To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

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

The mitigation measures identified within the Environmental Impact Assessment process are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Great Karoo Wind Farm (Pty) Ltd must ensure that the implementation of the project complies with the requirements of any and all environmental authorisations and permits (once issued), as well as with obligations emanating from all relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation for activities associated with both construction and operation. Since this EMPr is part of the EIA process undertaken for the proposed wind energy facility, it is important that this guideline document be read in conjunction with the Final Scoping Report (December 2011) and Amended Final EIA Report (April 2014). This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental process. This EMP for construction and operation activities has been compiled in accordance with Section 33 of the EIA Regulations of June 2010 and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. This EMPr should be considered a dynamic document, requiring regular review and updating as new information becomes available in order for it to remain relevant to the requirements of the site and the environment.

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

- Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees must be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an appropriate Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, the EMPr specifications, and how they are to be implemented.
- Basic training in the identification of archaeological sites/objects, and protected or Red List flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed to be necessary by the Environmental Control Officer (ECO).

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications as required throughout the life-cycle of the facility. This will ensure that the project activities are planned and implemented taking sensitive environmental features into account.

The Great Karoo Wind Farm (Pty) Ltd received an Environmental Authorisation (EA) for the construction of Great Karoo Wind Energy Facility (WEF) on the 12th of August 2014 (as subsequently amended on 25 July

2016 and 5 May 2017). In terms of this EA, the EMPr for the project is amendable (Condition 16), and must be implemented and strictly enforced. This EMPr forms part of an EA amendment application for the project and includes additional mitigation measures as required by the specialist team (2019).

This amendment entails an updated turbine model for the project and is proposing the following:

1. A reduction in the number of wind turbines from the authorised 52, to up to 42;
2. An increase to the rotor diameter for each wind turbine from the authorised diameter of up to 140m, to up to 180m;
3. An increase in hub height from up to 120m, to a range of up to 150m;
4. Turbine capacity from 3,6 MW, to up to 6,5 MW per turbine;
5. Update the layout as required based on the revised turbine numbers and turbine specifications;
6. Extend the validity period by an additional 5 years.
7. Amendment of Condition 13.2 of the EA:
   from:
   "A 150m and 100m buffer respectively between watercourses; ridge edge and the turbine/construction activities"
   To:
   "Turbine and infrastructure positions as approved by an avifaunal specialist"

8. Amendment of Condition 49 of the EA
   from:
   Condition 49, from:
   "A 150m between watercourses and 100m buffer between the ridge edge and the turbine/construction activities must be implemented."
   To:
   "The layout must be approved by the avifaunal specialist."

As required in terms of Regulation 32(1)(a)(iii), consideration was given to the requirement for additional measures to ensure avoidance, management and mitigation of impacts associated with the proposed change in the project details. From the specialist inputs provided into the amendment motivation, additional mitigation measures have been recommended. These additional mitigation measures have been shown in <u>underlined text</u> in this EMPr, to illustrate which measures are novel inclusions and relate to the 2019 amendment only.

# CHAPTER 2: PROJECT DETAILS

Great Karoo Wind Farm (Pty) Ltd **(herein referred to as the Project Company)** is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Karoo Hoogland Local Municipality (approximately 30 km south of Sutherland in the Northern Cape Province). This project is referred to as the Hidden Valley wind energy facility, which comprises of three development phases. *This EMPr deals with the **Great Karoo Wind Farm** (Phase 3 of the Hidden Valley project).* The facility will be powered by wind. No other fuels will be used as a generating fuel during the operational phase of the project. A layout of the wind turbines and grid connection options are shown on **Figure 1**.

The Great Karoo Wind Farm is proposed on the following farm portions (which collectively occupies land of 91.8 km$^2$ in extent):

- Farm Kentucky 206
- Portion 1 of Farm Wolvenkop 207

The primary components of the Great Karoo Wind Farm as per the current EA include the following:

- Up to 57[3] **wind turbines**, appropriately spaced to make use of the wind resource on the site. The facility is proposed to have a generating capacity of up to 150 MW, used depending on the final turbine selected for implementation but will be limited to 140MW at the point of connection with the Eskom grid. The facility would be operated as a single facility with each turbine being between 2 MW and 3.5 MW in capacity.
- Each wind turbine is expected to consist of a concrete foundation (20m x 20m), a steel or concrete tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades with a rotor diameter of up to 120m.
- Cabling between the components, laid approximately 1 m underground where underground cabling feasible. In as far as possible, cabling will follow the internal access roads.
- Internal roads (approximately 8 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines and the vast areas of the site which are not currently accessible will necessitate the construction of ~30 km of new access roads in some areas.
- A new 132 kV **substation** is proposed within this phase. The electricity from the 132 kV substation will be transmitted via a 132 kV **power line** to the 400 kV substation (located on the Phase 1 site) for connection to the Eskom grid. Two alternative substation locations and power lines are proposed.
- This proposed substation will have a high-voltage (HV) yard footprint of approximately 200m x 200 m.
- **Operations and service building area** for control, maintenance and storage (approximately 2000m$^2$).
- **Guard house** for access security of 50m$^2$.

[3] Initially 77 wind turbines were proposed but this has been reduced to 57 in response to assessments and specialist recommendations

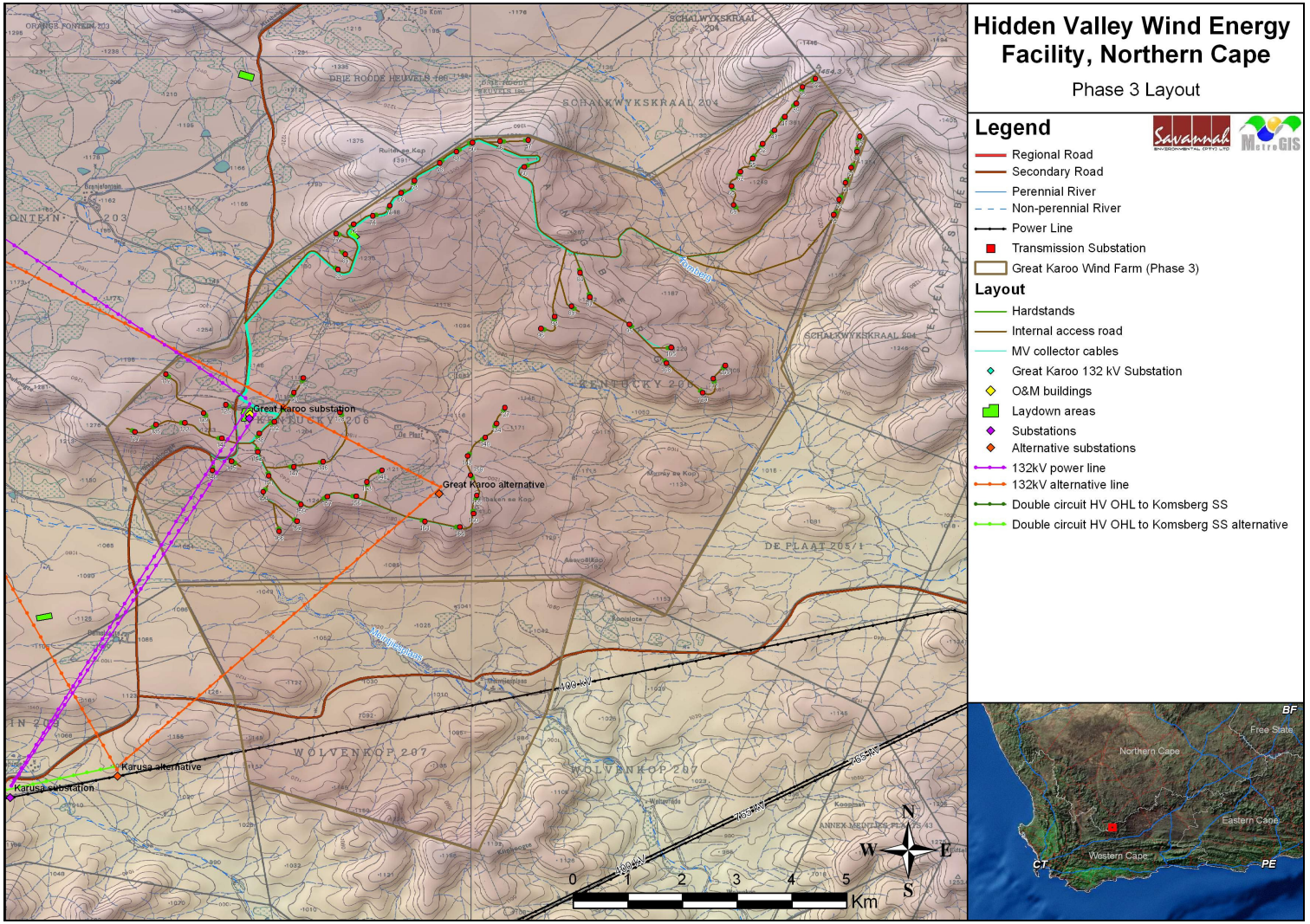


**Figure 1:** Layout for the Great Karoo Wind Farm (Phase 3 of the Hidden Valley project), as assessed within the EIA in 2014

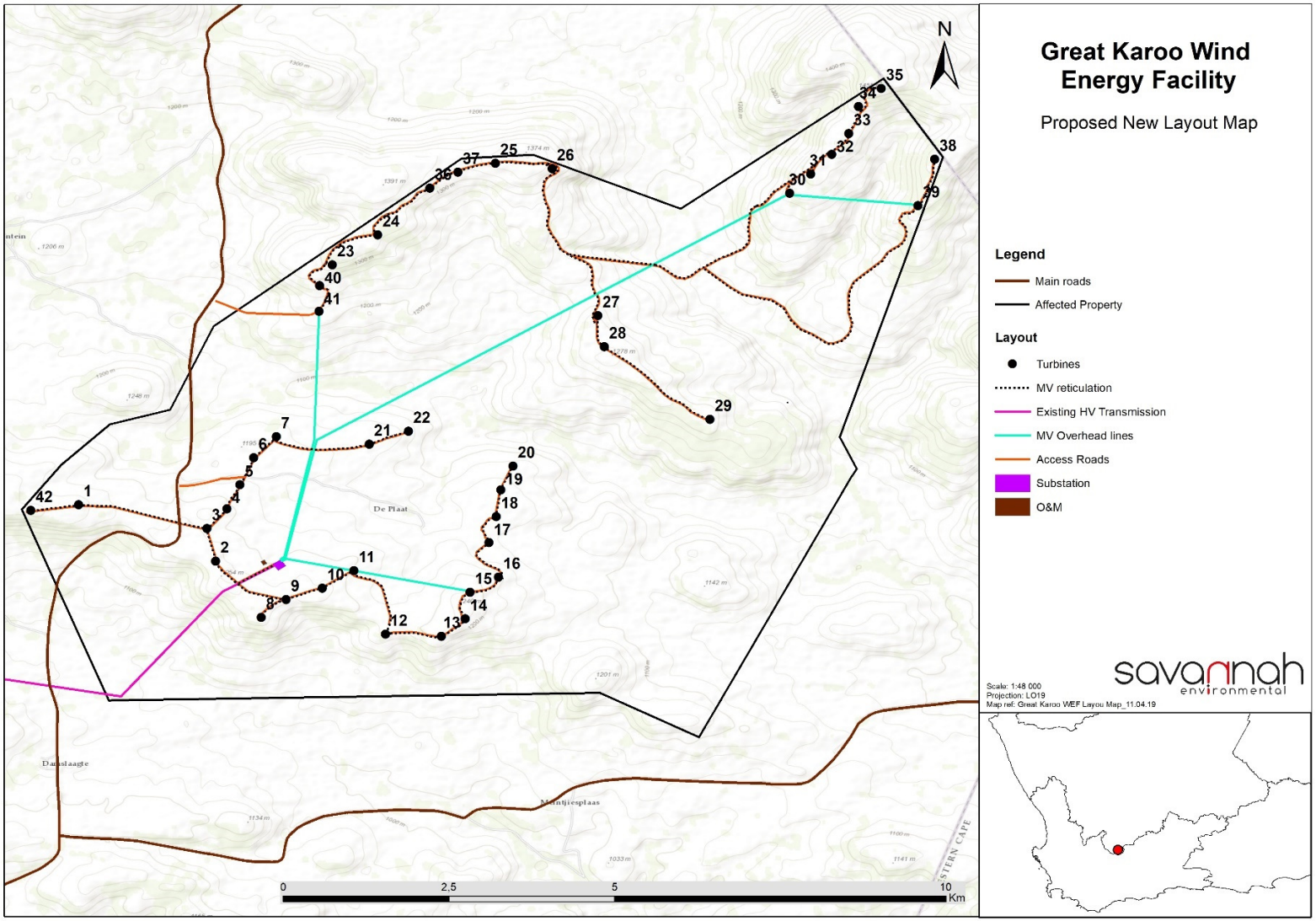


**Figure 2: Updated Great Karoo Wind farm layout**

## 2.1 Activities and Components associated with the Wind Energy Facility

The main activities/components associated with the Great Karoo Wind Energy Facility comprise the following:

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | ***Planning*** | |
| Conduct surveys | » Geotechnical survey by geotechnical engineer<br>» Site survey and confirmation of the turbine micro-siting footprints<br>» Survey of on-site substation (1) and chosen power line route<br>» Survey of internal access routes and water crossings<br>» Environmental walk-through surveys | » Surveys to be undertaken prior to initiating construction. |
| | ***Construction*** | |
| Establishment of access roads to the site | » Upgrade access/haul roads to the site<br>» Establish internal access roads: 8 m wide permanent roadway within the site between the turbines for use during construction and operation phase. | » Access roads will be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary.<br>» Existing access roads to the site will be utilised, and upgraded where required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation.<br>» The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as by surveys undertaken by ecological and avifaunal specialists). |
| Undertake site preparation | » Site establishment of offices/ workshop with ablutions and stores, contractors yards<br>» Establishment of internal access roads (permanent and temporary roads) | » These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site. |

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | » Clearance of vegetation at the footprint of each turbine<br>» Excavations for foundations | |
| Establishment of lay down areas on site | » Lay down areas (footprint 60 m x 60m) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment.<br>» Construction site office | » The lay down area will need to accommodate the cranes required in tower/turbine assembly.<br>» Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.<br>» A large lay down area will be required at each position where the main lifting crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the main crane from all sides. |
| Construct wind turbine foundations | » Turbine foundations will be up to 20 m x 20m. Foundation holes will be excavated to a depth of approximately 4m-6m, depending on the underlying geotechnical conditions on site | » Foundation holes will be mechanically excavated where possible and blasted where required.<br>» Safety barriers will be erected around open excavations. |
| Establishment of onsite batching plants | » A batching plant will be required for construction covering approximately 50m x 50m | » Batching plant equipment will need to be installed<br>» A small office may be necessary<br>» A lay down area will need to accommodate aggregate material for batching. |
| Transport of components and equipment to site | » Ttrucks will be used to transport all components to site:<br>* The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.).<br>* The components required for the establishment of the substation | » Turbine units consist of a tower comprised of a number of segments, a nacelle, rotor and three blades.<br>» Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and a main crane) to erect the wind turbines.<br>» Other components include components required for the establishment of the substation (including transformers) and those required for the establishment of the power line (including towers and cabling).<br>» The wind turbine, including tower, will be brought to site by the supplier |

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | (including transformers)<br>* Components required for the establishment of the power line (including towers and cabling) | in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. It is estimated that 10-14 trucks will be used for the transport of each turbine. |
| Erect turbines | » Large lifting crane used for lifting of large, heavy components<br>» A small crane for the assembly of the rotor. | » The large lifting crane will lift the tower sections into place, assisted by the smaller crane.<br>» The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower.<br>» The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground by the smaller crane. It will then be lifted to the nacelle by the large crane, and bolted in place. Alternatively the blades may be lifted into position on the nacelle individually by the main crane.<br>» It will take approximately 2-5 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor. |
| Construct substation and ancillary infrastructure. | » New up to 400 kV **substation complex** will connect via a new power line to Eskom Komsberg substation. The new on-site up to 400 kV substation will be located adjacent to the existing 400 kV line to allow for a direct connection. | » Will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction.<br>» A lay down area for building materials and equipment associated with these buildings will also be required.<br>» The substation will be constructed within a high-voltage (HV) yard |

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | » Substation components<br>» Security fencing around high-voltage (HV) Yard<br>» Workshop<br>» Operation and Maintenance Office | footprint of up to 40 000 m$^2$.<br>» The substation would be constructed in the following simplified sequence:<br>* Step 1: Survey of the site<br>* Step 2: Site clearing and levelling and construction of access road to substation sites<br>* Step 3: Construction of terrace and foundations<br>* Step 4: Assembly, erection and installation of equipment<br>* Step 5: Connection of conductors to equipment<br>* Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas. |
| Connection of wind turbines to the on-site substation | » Wind turbines<br>» 33 kV electrical cabling connecting each turbine to the substation | » The installation of these cables will require the excavation of trenches, approximately 1m in depth within which these cables can then be laid.<br>» The underground cables would follow the internal access roads as far as reasonably possible.<br>» Where underground cabling is not practical or environmentally sensible (e.g. in rocky area where blasting would be required), cabling would be above ground, suspended between ~8m high timber poles at ~60m centres. |
| Connect substation to power grid | » A new on-site substation (with a capacity of up to 400kV) to connect directly to the Komsberg Substation located in the south-west corner of the site development footprint<br>» Overhead 132 kV double circuit power line to connect the substation to the Eskom grid at the Komsberg Substation, requiring a servitude of approximately 36 m in width. | » The route for the substations and power lines will be assessed, surveyed and pegged prior to construction. |
| Commissioning of the facility | » Wind energy facility commissioning | » Prior to the start-up of a wind turbine, a series of checks and tests will |

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | | be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits.<br>» Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. |
| Undertake site remediation | » Remove all construction equipment from the site<br>» Rehabilitation of temporarily disturbed areas where practical and reasonable | » On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation. |
| ***Operation*** | | |
| Operation | » Operation of turbines within the wind energy facility | » Once operational, the wind energy facility will be monitored remotely. Based on information provided by the proponent, the proposed project will employ between 12 and 17 permanent employment opportunities as well as shorter term contract work. The operational phase is expected to last 20 years. It is anticipated that there will be full time security, maintenance and control room staff required on site.<br>» Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. |
| Maintenance | » Oil and grease – turbines<br>» Transformer oil – substation<br>» Waste product disposal | » The wind turbines will be subject to periodic maintenance and inspection. Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.<br>» The turbine infrastructure is expected to have a lifespan of approximately 20 years, with maintenance. |
| ***Decommissioning*** | | |
| Site preparation | » Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes.<br>» Preparation of the site (e.g. lay down | » Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. This may be longer than the 20 year envisaged life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the |

| Main Activity/Project Component | Components of Activity | Details |
|---|---|---|
| | areas, construction platform)<br>» Mobilisation of construction equipment | disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time. |
| Disassemble and remove existing turbines | » A large crane will be used to disassemble the turbine and tower sections. | » Turbine components would be reused, recycled or disposed of in accordance with regulatory requirements.<br>» The hours of operation for noisy construction activities are guided by the Environment Conservation Act (noise control regulations). If the project requires construction work outside of the designated hours, regulatory authorities and affected stakeholders will be consulted and subsequent negotiations will be made to ensure the suitability of the revised activities (if applicable). |

## 2.2 Findings of the Environmental Impact Assessment

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

- Disturbance of ecological environment;
- Potential impacts on drainage lines and other sensitive habitats, mainly from access roads;
- Potential impacts on avifauna (birds) although no turbines are in high risk areas;
- Potential impacts on bats although no turbines are in high risk areas;
- Potential disturbance to sense of place, visual aesthetics;
- Noise during construction;
- Socio-economic impacts;
- Potential soil erosion and degradation; and
- Potential impacts on heritage and/ fossil resources (if disturbed).

From the specialist investigations undertaken for the proposed wind energy facility development site, a number of potentially sensitive areas were identified (refer to Figure 3):

- Vegetation of conservation importance: this is based primarily on the location of the site within the Hantam-Roggeveld Centre of Endemism and the Fynbos Biome and which falls within the Namakwa District Biodiversity Sector Plan (NDBSP), Critical Biodiversity Area (CBA) T2 (for this site - important terrestrial habitats that are **south-facing slopes** larger than 25 ha in size, kloofs and habitat for riverine rabbit, therefore with high biodiversity) (medium sensitivity). Areas classified as mountains, ridges or **steep slopes**: some of the steeper scarp slopes of the study area are steep enough to be sensitive to erosion and downslope impacts from disturbance and have been identified as important biodiversity habitats (essential T2 areas from the NDBSP) (high sensitivity).
- Potential areas for the occurrence of populations of Red List fauna and flora that have been evaluated as having a probability of occurring in **natural habitats** within the study area.
- Perennial and non-perennial rivers, streams and **watercourses**. These support the ecosystems in the areas and may provide habitat for priority avifauna species.
- Noise sensitive receptors (farmsteads on / around the site, albeit limited).
- Heritage artefacts (graves, stone walls and old buildings/ruins present on the site). (Note that no infrastructure is proposed on the identified heritage sites).
- Areas of high bat sensitivity also include rivers, farm dams and slopes. No turbines occur in the areas of high bat sensitivity.
- Areas of high avifaunal sensitivity have been identified and no turbines are in high risk areas.

In response to the identified need to adequately manage impacts within sensitive areas identified on the site development footprint, and in order to demonstrate the ability of the project to adhere to recommended mitigation measures, the project developer has developed a mitigation strategy with regards to the facility layout.

The EIA recommendations have been taken into account by the project developer, and the wind turbine layout has been refined to avoid the areas identified as being of high sensitivity. This refinement of the layout has resulted in the removal of turbines from the layout completely and the repositioning of turbines outside of identified sensitive areas. This layout considering the required mitigation measures is included in

Figure 12.2, and represents the optimal layout for the facility. This refined layout shows a change in wind turbines from 77 to 57.

The table below summarises which wind turbines have been moved out of sensitive areas, and which turbines have been removed from the layout.

| **Turbine Number - EIA-assessed layout for Phase 3** | **Reason for repositioning of turbine** |
|---|---|
| 75, 76, 149, 154, | Avifaunal risk – 4 wind turbines placed within a high risk area.<br>Action: 4 turbines **removed** from the layout |
| 125 | Bat risk – One wind turbine occurred in a moderate bat sensitivity buffer area (movement not required but developer adhering to best practice)<br>Action – one wind turbine was **removed** from the layout |
| 151, 154, 157, 162 | Bat risk – 4 wind turbines placed immediately outside of moderate bat sensitivity buffer (movement not required but developer adhering to best practice)<br>Action: four wind turbines **removed** from the layout |

The refined layout now has a reduced number of wind turbines for the Great Karoo Wind Farm site. The turbines have been reduced from 77 to 57. (i.e. 20 less turbines are proposed for construction within the Great Karoo Wind Farm).

## 2.2 Findings of the EA Amendment process

It is proposed that this number of turbines be further reduced to up to 42 turbines through the EA amendment process. Based on the specialist findings, it is concluded that the proposed amendments to the turbine specifications, wind farm layout and Conditions of the EA are not expected to result in an increase to the significance ratings for the identified potential impacts. In some cases (avifauna and bats), the quantitative value has changed in terms of the magnitude of impacts, but this has not resulted in a change to the qualitative category (i.e. Low, Medium. High) of the significance rating after mitigation measures. There is a reduction in significance in some impacts as a result of the reduced number of turbines and the location of these outside of identified high sensitivity areas.

In addition, the amended wind turbine positions considered avoids all identified avifaunal exclusion zones and areas of high sensitivity (refer to Figure 4). One turbine, turbine 39, remains in the avifaunal exclusion zone. The avifaunal specialist concluded that this is unlikely to result in a significant increase in the overall collision impact rating of the site and that the location of this turbine is acceptable. It was recommended that fieldwork be done in the eagle breeding season to determine the activity status and species utilising the three nests recorded on site. These results must inform possible additional mitigation measures and the final micro-siting of the layout, which will be submitted to the DEA for approval in terms of the requirements of Condition 13 of the EA dated August 2014. Operational phase bird monitoring programme was also recommended by the avifaunal specialist (in line with the guidelines applicable at the start of the operational phase).

The bats specialist report concluded that the amendments to the turbine dimensions proposed at the Great Karoo Wind Farm would slightly increase mortality impacts to bats, but that the overall impact significance would remain unchanged. Based on bat activity levels as assessed from pre-construction monitoring data, impacts to bats are likely to be of a medium significance before mitigation and low after mitigation. Is was recommended that ground clearance be maximised and the tip height (i.e. the distance between the ground and the blade tip at its height point) be minimised as far as possible in the final turbine selection. Cumulative impacts on bats after mitigation would also increase due to the increased number of third-party projects now proposed within 50km of the site. Cumulative impacts are likely to be of a high significance before mitigation and medium after mitigation.

In terms of aspects relating to heritage, visual and noise, the proposed changes to the EA and site layout plan will not increase the significance of impacts originally identified in the EIA report or lead to any additional impacts.

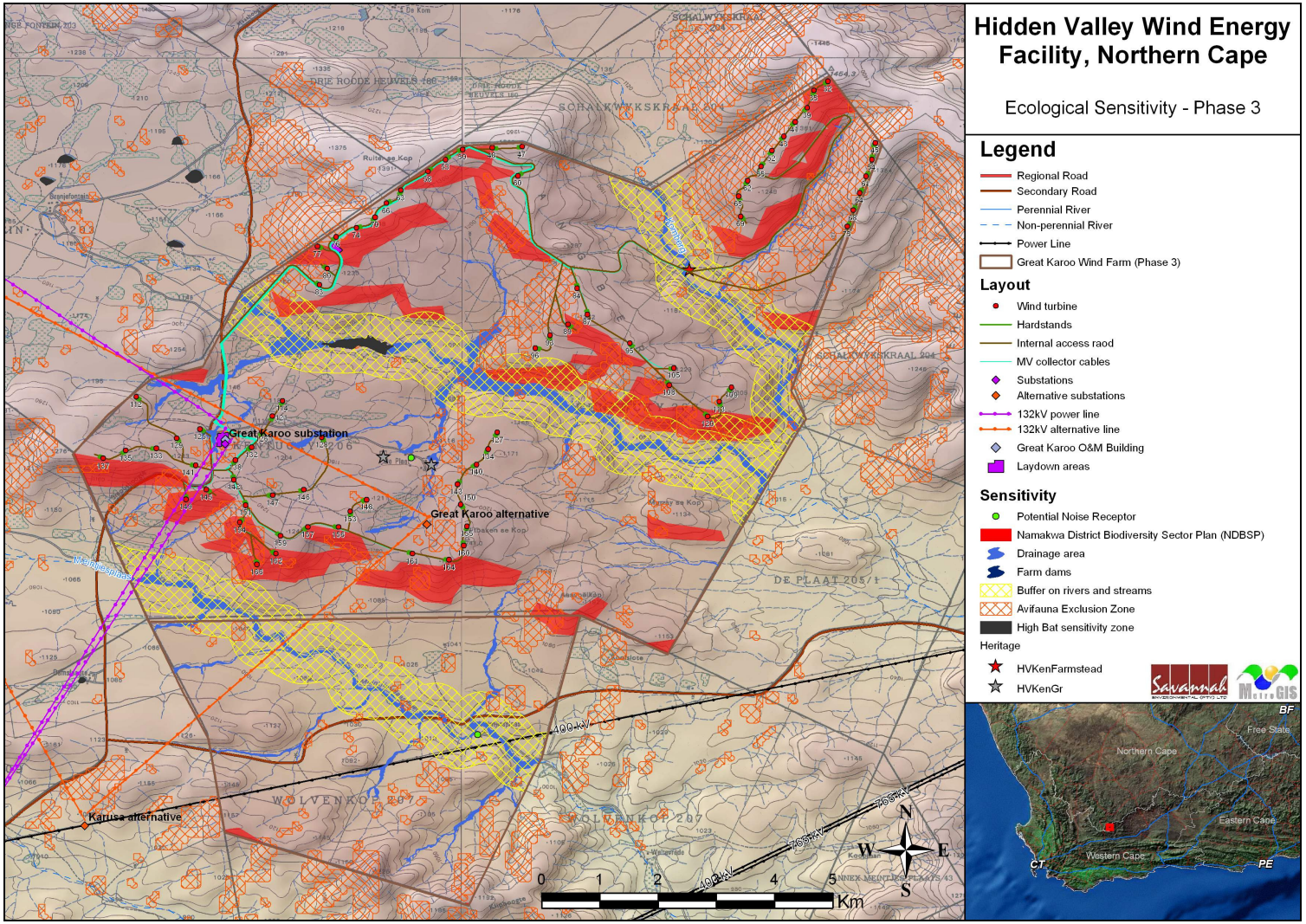


**Figure 3:** Environmental Sensitivity map for the project study area illustrating sensitive areas in relation to the Great Karoo Wind Farm (as taken from the EIA report)

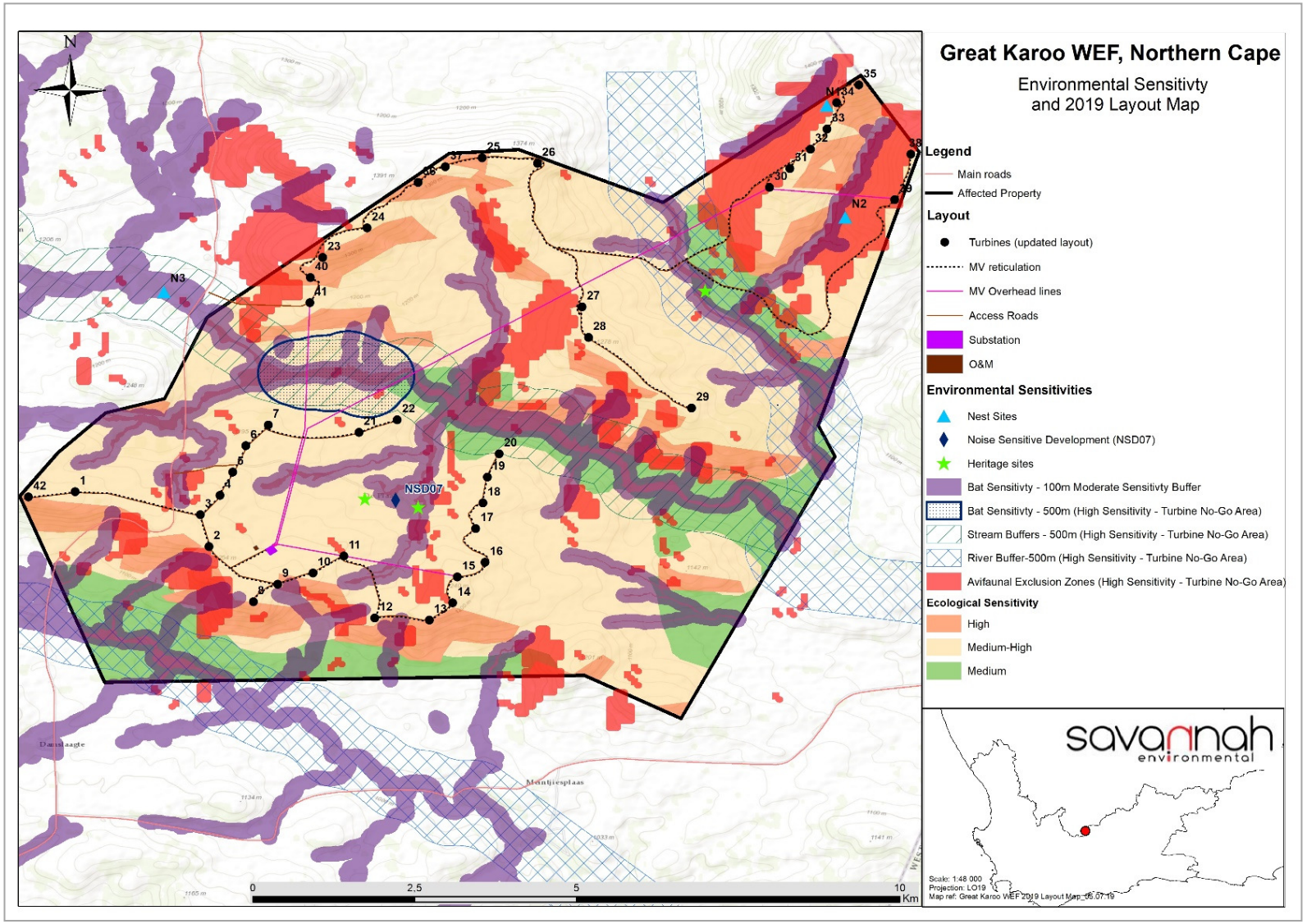


**Figure 4:** Updated wind farm layout with specialist environmental sensitivities

## 2.2 Applicable Legislation

The following legislation and guidelines have informed the scope and content of this EMPr:

- National Environmental Management Act (Act No 107 of 1998);
- EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  - Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006);
  - Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006);
  - Public Participation in the EIA Process (DEA, 2010);
  - Integrated Environmental Management Information Series (published by DEA); and
- International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table in Table 2.1.

equirements applicable to the Wind Energy Facility Project EIA

| uirements | Relevant Authority | Compliance requirements |
|---|---|---|
| have been promulgated in er 5. Activities which may not without an environmental are identified within these<br><br>ection 24(1) of NEMA, the act on the environment these listed activities must be nvestigated, assessed and the competent authority (the charged by NEMA with he relevant environmental<br><br>387 of 21 April 2006, a scoping s is required to be undertaken d project | » National Department of Environmental Affairs<br>» Department of Environmental and Nature Conservation (DENC) – commenting authority | An EIA report was submitted to the DEA and Provincial Environmental Department in support of the application for authorisation. An EA was issued for the project. |
| Duty of Care provision in S28(1) roponent must ensure that asures are taken throughout this project to ensure that any gradation of the environment h this project is avoided, mised. | Department of Environmental Affairs (as regulator of NEMA). | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | cumulative effect of a variety of impacts. | | |
| National Environmental Management: Waste Act (Act No 59 of 2008) | The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.<br><br>The Minister may amend the list by –<br>» Adding other waste management activities to the list.<br>» Removing waste management activities from the list.<br>» Making other changes to the particulars on the list.<br><br>In terms of the Regulations published in terms of this Act (GN 912), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.<br><br>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:<br><br>» The containers in which any waste is stored, are intact and not corroded or in<br>» any other way rendered unlit for the safe storage of waste.<br>» Adequate measures are taken to prevent accidental spillage or leaking.<br>» The waste cannot be blown away.<br>» Nuisances such as odour, visual impacts | National Department of Water and Environmental Affairs (hazardous waste)<br><br>Provincial Department of Environmental Affairs (general waste) | A waste license is required for the ash dump associated with the power station.<br><br>General waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in this EMPr. The DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste will also need to be considered. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | and breeding of vectors do not arise; and<br>» Pollution of the environment and harm to health are prevented. | | |
| Environment Conservation Act (Act No 73 of 1989) | In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.<br><br>Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Northern Cape province have not yet adopted provincial regulations in this regard.<br><br>Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns | National Department of Environmental Affairs<br><br>Provincial Environmental Department - commenting authority.<br><br>Local authorities<br><br>Local Municipality | There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix K of the EIA report). There are noise level limits which must be adhered to. |
| National Water Act (Act No 36 of 1998) | Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999.<br>In terms of Section 19, the project proponent must ensure that reasonable measures are | Department of Water Affairs | A water use permits or licenses are required to be applied for or obtained, if infrastructure such as access roads cross drainage lines. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring. | | |
| National Water Act (Act No 36 of 1998) | In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring. | Department of Water Affairs (as regulator of NWA) | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project. |
| Minerals and Petroleum Resources Development Act (Act No 28 of 2002) | A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act.<br><br>Requirements for Environmental Management Programmes and Environmental Management Plans are set out in Section 39 of the Act. | Department of Mineral Resources | If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained. |
| National Environmental Management: Air Quality Act (Act No 39 of 2004) | Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality.<br><br>Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.<br><br>Section 34 makes provision for:<br>(1) the Minister to prescribe essential national noise standards -<br>(a) for the control of noise, either in general or by specified machinery or activities or in | National Department of Environmental Affairs – air quality<br><br>Local Municipality - Noise | No permitting or licensing requirements applicable for air quality aspects.<br><br>The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.<br><br>An atmospheric emission licence issued in terms of section 22 may contain conditions in respect of noise. This will however, not be relevant to the facility, as no atmospheric emissions will take place.<br><br>The Act provides that an air quality officer may require any |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | specified places or areas; or<br>(b) for determining –<br>(i) a definition of noise<br>(ii) the maximum levels of noise<br>(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.<br>» The Draft National Dust Control Regulations prescribe measures for the control of dust in all areas including residential and light commercial areas. | | person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. |
| National Heritage Resources Act (Act No 25 of 1999) | Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including<br>» the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;<br>» any development or other activity which will change the character of a site exceeding 5 000 $m^2$ in extent.<br><br>The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 $m^2$; or the re-zoning of a site exceeding 10 000 $m^2$ in extent. This notification must be | South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. | Section 4 of the NHRA provides that within 14 days of receipt of notification the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe a heritage resource may be affected.<br><br>A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.<br><br>Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component. | | |
| National Environmental Management: Biodiversity Act (Act No 10 of 2004) | » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53)<br>» A list of threatened & protected species has been published in terms of S 56(1) - Government Gazette 29657.<br>» Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).<br>» Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of | National Department of Environmental Affairs | As the applicant will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard.<br>Specialist ecological studies are required to be undertaken as part of the EIA process. These studies have been undertaken as part of the previously EIAs undertaken for the site. A specialist ecological assessment has been undertaken for the proposed project (refer to Appendix F of the EIA report).<br><br>A permit may be required should any protected plant species on site be disturbed or destroyed as a result of the proposed development. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011).<br>» This Act also regulates alien and invader species.<br>» Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.<br><br>The developer has a responsibility for:<br>» The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).<br>» Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the | | |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | area are in line with ecological sustainable development and protection of biodiversity.<br>» Limit further loss of biodiversity and conserve endangered ecosystems. | | |
| Conservation of Agricultural Resources Act (Act No 43 of 1983) | Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:<br>» Category 1 plants: are prohibited and must be controlled.<br>» Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.<br>» Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.<br><br>These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E. | Department of Agriculture, Forestry and Fisheries | While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.<br><br>The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. |
| National Veld and Forest | In terms of Section 12 the applicant would be | | While no permitting or licensing requirements arise from this |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| Fire Act (Act 101 of 1998) | obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land.<br><br>In terms of section 13 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material.<br><br>In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires. | | legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency. |
| National Forests Act (Act No 84 of 1998) | Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.<br><br>Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence. | Department of Agriculture, Forestry and Fisheries | A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. |
| Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997 | Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km | Civil Aviation Authority (CAA) | While no permitting or licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | radius around such structure.<br><br>Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified.<br><br>Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft.<br><br>Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities. | | |
| Hazardous Substances Act (Act No 15 of 1973) | This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.<br><br>» Group I and II: Any substance or mixture of a substance that might by reason of its | Department of Health | It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance;<br>» Group IV: any electronic product;<br>» Group V: any radioactive material.<br><br>The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. | | |
| National Road Traffic Act (Act No 93 of 1996) | The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.<br><br>Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.<br><br>The general conditions, limitations and escort requirements for abnormally dimensioned | Provincial Department of Transport (provincial roads)<br>South African National Roads Agency Limited (national roads) | An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include:<br>» Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.<br>» Transport vehicles exceeding the dimensional limitations (length) of 22m.<br>» Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width). |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations. | | |
| Development Facilitation Act (Act No 67 of 1995) | Provides for the overall framework and administrative structures for planning throughout the Republic.<br>Sections 2- 4 provide general principles for land development and conflict resolution. | Karoo Hoogland Local Municipality | The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA. |
| Subdivision of Agricultural Land Act (Act No 70 of 1970) | Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land, or for the registration of a lease for longer than 10 years. | Consent of Minister of Agriculture to subdivide, or register long lease or servitude, in respect of agricultural land. | Subdivision will have to be in place prior to any subdivision approval in terms of in terms of Section 24 and 17 of LUPO.<br>Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project. |
| Promotion of Access to Information Act (Act No 2 of 2000) | » All requests for access to information held by state or private body are provided for in the Act under S11. | National Department of Environmental Affairs (DEA) | No permitting or licensing requirements. This act may find application during through the project EIA. |
| Promotion of Administrative Justice Act (Act No 3 of 2000) | » In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions<br>» Interested & affected parties have right to be heard | National Department of Environmental Affairs (DEA) | No permitting or licensing requirements. This act will find application during through the project EIA. |
| ***Provincial Legislation/ Policies / Plans*** | | | |
| Northern Cape Nature | To provide for the sustainable utilisation of wild | Northern Cape Department of | The owner of land upon which an invasive species is |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| Conservation Act, 2009 | animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith. | Environmental Affairs and Nature Conservation | found, must take the necessary steps to eradicate or destroy such species. |
| Astronomy Geographic Advantage Act (Act 21 of 2007) | » Preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy.<br>» Regulations promulgated in terms of AGA in 2009 require all developments in the Sutherland area that entail external night lighting, to be fully cut-off, with no light emitted in the upward direction. This is aimed at protecting the observational integrity of SALT (Southern African Large Telescope), the largest telescope in the Southern Hemisphere, located approximately 20 km east of Sutherland.<br>» In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. in this regard, all land within a 3 kilometres radius of the centre | Department of Science and Technology | No permitting or licensing requirements. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | of the Southern African large Telescope dome falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope. The study area does not fall within the 3 km radius of SALT or within an area which could affect the MeerKAT and SKA developments.<br>» Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavour. | | |
| ***Local Legislation / Policies / Plans*** | | | |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| Karoo Hoogland Local Municipality Integrated Development Plan (IDP) | » The IDP notes that the Karoo Hoogland is primarily an agricultural community. Conservation of the environment and sustainable development are identified as primary points of departure in policy.<br>» The main socio-economic developmental issues are identified as widespread poverty, the lack of employment opportunities, low adult literacy levels, and general the lack of diversified skills amongst the bulk of the population. School dropout rates are pronounced. The IDP describes general living conditions in the LM as "some of the worst in the country". | Karoo Hoogland Local Municipality | » New developments in the municipality to be in line with the IDP. |
| ***Standards*** | | | |
| Noise Standards | Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are:<br>» SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.<br>» SANS 10210:2004. 'Calculating and predicting road traffic noise'.<br>» SANS 10328:2008. 'Methods for environmental noise impact assessments'.<br>» SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. | Local Municipality | The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful per se. |

| Legislation / Policy / Guideline | Applicable Requirements | Relevant Authority | Compliance requirements |
|---|---|---|---|
| | The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. | | |

# CHAPTER 3: STRUCTURE OF THIS EMPR

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

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

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

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

| | |
|---|---|
| **Project component/s** | List of project components affecting the objective, i.e.:<br>» wind turbines;<br>» access roads;<br>» substation; and<br>» power line. |
| **Potential Impact** | Brief description of potential environmental impact if objective is not met. |
| **Activity/risk source** | Description of activities which could impact on achieving objective. |
| **Mitigation: Target/Objective** | Description of the target; include quantitative measures and/or dates of completion. |

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

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

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

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

## 3.1. Project Team

This draft EMPr was compiled by:

| **EMP Compilers** | |
|---|---|
| Ravisha Ajodhapersadh (2014) | Savannah Environmental |
| Hermien Slabbert (2019) | Savannah Environmental |
| Gideon Raath (2019) | Savannah Environmental |
| Jo-Anne Thomas (2019) | Savannah Environmental |
| Karen Jodas (2014) | Savannah Environmental |
| **Input from Specialists** | |
| Ecology | David Hoare Consulting cc (2014) and 3 Foxes Biodiversity Solutions (2019) |
| Avifauna | Endangered Wildlife Trust (EWT) (2014) and Arcus Consulting (2019) |
| Soils and Land-Use | TerraSoil Science (2014) |
| Visual | MetroGIS (2014) and LOGIS (2019) |
| Heritage | Albany Museum (2014) and CTS Heritage (2019) |
| Palaeontology | Lloyd Rossouw (2014) |
| Noise | MENCO (2014) and Enviro Acoustic Research (2019) |
| Social Impact | Tony Barbour (Environmental Consultant and Researcher) (2014 & 2019) |
| Bats | Animalia cc (2014) and Arcus Consulting (2019) |

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, and have managed and drafted Environmental Management Programmes for other wind energy facility projects throughout South Africa. In addition, they have been involved in compliance monitoring of major construction projects in South Africa.

# CHAPTER 4: MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: PLANNING & DESIGN

## 4.1. Planning and Design

**OBJECTIVE 1 : To ensure that the design of the facility responds to the identified environmental constraints and opportunities**

Subject to final turbine micro-siting and subsequent acceptance from DEA, the layout and preferred grid connection option must be implemented.

| | |
|---|---|
| **Project component/s** | Project components affecting the objective:<br>» wind turbines;<br>» access roads and crane hard standings;<br>» substation;<br>» service building; and<br>» power line. |
| **Potential Impact** | » Design fails to respond optimally to the environmental consideration. |
| **Activities/risk sources** | » Positioning of turbines and access roads<br>» Positioning of substation<br>» Alignment of overhead power lines |
| **Mitigation: Target/Objective** | » To ensure that the design of the facility responds to the identified environmental constraints and opportunities.<br>» To ensure that the design of the facility responds to the identified constraints identified through pre-construction bird and bat monitoring. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| The developer to finalise layout of all components, and submit to DEA for approval. | Project Company, Contractor | Prior to construction |
| Additional avifaunal pre-construction monitoring must be conducted. This monitoring can be refined, and focussed on the Great Karoo WEF, and it is not necessary to repeat the full protocol conducted by EWT (2014). The monitoring data collected will update the avifaunal baseline for the site, to allow for meaningful comparison with operational monitoring data, and it must also be used to inform the final micro-siting of the WEF where applicable. | Project Company | Prior to construction |
| The nests sites, N1-N3, must be revisited by an avifaunal specialist during the eagle breeding season (e.g. approximately June-September) to confirm the activity of these sites and the species utilising these sites (if active). Once the above has been completed, the specialist must advise any additional recommendations and/or mitigations, which may result in a need to update the EMPr for the project and/or refine the final | Project Company | Prior to construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| layout of the turbines. If any active nest sites of eagles are confirmed, these nests sites must be re-visited and regularly surveyed to determine the breeding success of eagles. Monitoring of any such active eagle nest sites should continue in to the construction phase of the project, and throughout the operational lifespan of the project, in accordance with the applicable guidelines in effect at the time. | | |
| Consider design level mitigation measures recommended by the specialists, especially with respect to ecology, visual aesthetics, drainage lines and avifauna as detailed within the EIA report and relevant appendices. | Project Company, Contractor | Tender Design & Design Review Stage |
| Access roads to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil. That is, keep grazing and natural units as intact as possible. | Project Company, Contractor | Design phase |
| Any further changes to the road or turbine positions should be checked by an ecological specialist to ensure that any high ecological sensitivity areas and features at the site are not affected. | Project Company | Prior to construction |
| Turbines which maximise the ground clearance as much as possible, and minimise the tip height (i.e. the distance between the ground and the blade tip at its highest point) should be used. | Project Company | Prior to construction |
| A comprehensive stormwater management to be compiled that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces. | Contractor | Design phase |
| The draft EMPr should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project. | Project Company, Contractor | Tender Design & Design Review Stage |
| The final location of the wind turbines and associated infrastructure (including access roads, the substation location and power line alignments) must be informed by a survey undertaken by an ecological specialist to identify any of the Red List plant species that have a geographic distribution in the areas, this includes:<br>» *Vulnerable species (Romulea eburnea, Lotononis venosa and Geissorhiza karooica); and*<br>» *Rare species (Cleretum lyratifolium and Strumaria karooica).*<br>The findings of this survey must be included in the | Project Company, Contractor | Design phase |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| updated EMPr to be compiled for the project. Prior to construction, the footprint of each turbine and power line tower must be searched for the relevant populations of plant species of concern. If any populations are found in these areas, infrastructure should be moved to avoid impacts. If not possible to avoid the impact, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species. | | |
| A walk-through survey by an ecologist and avifaunal specialist to be undertaken for the final power line route, and sections of the power line which cross sensitive habitats should be demarcated. | Project Company, Contractor, ecologist, avifaunal specialist | Design phase |
| The Ecological preconstruction walk-through will need to locate and identify species of conservation concern that are within the development footprint. | Project Company and Contractor | Project Company |
| Prior to construction, a walk-down of the amended layout must be conducted by a qualified archaeologist to ensure that no heritage resources are to be impacted by the new locations of the turbines. If heritage resources are identified at or near any proposed infrastructure, an assessment of the significance of the heritage resources and the impact to the identified heritage resource must be completed. A report detailing the results of the survey must be submitted to SAHRA before construction commences. Permits must be obtained to impact on any heritage sites of significance. | Project Company | Pre-construction |
| Water use license to be obtained for any impacts on wetlands / drainage lines (if applicable). | Project Company, Contractor | Design phase |
| Water use license (or General Authorisation) to be obtained for abstraction of water from on-site borehole/s for construction o operation purposes. | Project Company, Contractor | Design phase |
| Mining permit/license to be obtained for any borrow pits to be established for the project (if applicable). | Contractor | Design phase |
| A ridge survey is undertaken for the identification of nesting sites before construction. | Project Company, , ecologist, avifaunal specialist | Design phase |
| Obtain required abnormal load permits for transportation of project components to site. | Contractor | Design phase |
| Determine an appropriate location for onsite batching | Contractor | Design phase |
| A detailed geotechnical investigation is required for the design phase. | Contractor | Design phase |
| Develop and implement a storm water management plan for the construction and operational phase and append it to the EMPR | Project Company | Design phase |

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

# CHAPTER 5: MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: CONSTRUCTION

## 5.1. Overall Goal for Construction

The construction phase of the wind energy facility should be undertaken in such a way that ensures the construction activities are properly managed in respect of environmental aspects and impacts and enables the wind energy facility construction activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, traffic and road use, and effects on local residents. The construction phase of the facility should also be undertaken in such a way as to minimise the impact on the vegetation, fauna and avifauna on the site as well as on any archaeological and historical value the site may have, as determined by the EIA.

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

The proponent must ensure that the implementation of the Power Station complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation. These are outlined below. The developer will retain various key roles and responsibilities during the construction of the wind energy facility.

Specific responsibilities of the Owner's Representatives; Environmental Control Officer and EPC Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

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

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

» Be fully knowledgeable with the contents of the Environmental Impact Assessment.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation.
» Be fully knowledgeable with the contents of the EMPr.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Have overall responsibility of the EMPr and its implementation.
» Conduct audits to ensure compliance to the EMPr.

- Ensure there is communication with the Project Manager, the Environmental Control Officer/s and relevant discipline Engineers on matters concerning the environment.
- Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
- Confine activities to the demarcated construction site.

An independent **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any authorised activities. The ECO will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. The ECO must:

- Be fully knowledgeable of the contents with the Environmental Impact Assessment.
- Be fully knowledgeable of the contents with the conditions of the Environmental Authorisation (once issued).
- Be fully knowledgeable of the contents with the EMPr.
- Be fully knowledgeable of the contents with all relevant environmental legislation, and ensure compliance with them.
- Be fully knowledgeable of all the licences and permits issued to the site.
- Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- Ensure that the compliance of the EMPr is monitored through regular and comprehensive inspection of the site and surrounding areas.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- Ensure that activities on site comply with all relevant environmental legislation.
- Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
- Ensure that any non-compliance or remedial measures that need to be applied are reported.
- Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- Independently report to DEA in terms of compliance with the specifications of the EMPr and conditions of the Environmental Authorisation (once issued).
- Keep record of all reports submitted to DEA.

The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

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

- Ensuring adherence to the environmental management specifications.
- Ensuring that Method Statements are submitted to the Site Manager for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMPr.
- Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
- Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.

- Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
- Ensuring that a register of all public complaints is maintained.
- Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations).

**Contractor's Environmental Representative:** The Contractor's Environmental Representative (CER), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the CER must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's Environmental Representative must:
- Be well versed in environmental matters.
- Understand the relevant environmental legislation and processes.
- Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
- Know the background of the project and understand the implementation programme.
- Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
- Keep accurate and detailed records of all EMPr-related activities on site.

## 5.3. Objectives for the Construction EMPr

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

**OBJECTIVE 2 : Securing the site and site establishment**

The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English and any other relevant indigenous languages, all to the approval of the Site Manager. All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape). Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.

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|---|---|
| **Project component/s** | Project components affecting the objective:<br>» wind turbines;<br>» access roads;<br>» substation;<br>» power line; and<br>» service buildings. |
| **Potential Impact** | » Hazards to landowners and public<br>» Security of materials |

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|---|---|
| | » Substantially increased damage to adjacent sensitive vegetation |
| **Activities/risk sources** | » Open excavations (foundations and cable trenches)<br>» Movement of construction vehicles in the area and on-site |
| **Mitigation: Target/Objective** | » To secure the site against unauthorised entry<br>» To protect members of the public/landowners/residents |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Secure site, working areas and excavations in an appropriate manner. | Contractor | During site establishment Maintenance: for duration of Contract. |
| Where necessary to control access, fence and secure access to the site and entrances to the site. | Contractor | During site establishment Maintenance: for duration of Contract. |
| Fence and secure Contractor's equipment camp. | Contractor | Erection: during site establishment Maintenance: for duration of Contract. |
| Location of concrete batching plant/s to be approved by ECO, prior to its establishment. | ECO | During site establishment |

| | |
|---|---|
| **Performance Indicator** | » Site is secure and there is no unauthorised entry.<br>» No members of the public/ landowners injured. |
| **Monitoring and Reporting** | » Regular visual inspection of fence for signs of deterioration/forced access.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site.<br>» ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager.<br>» ECO to address any infringements with responsible contractors as soon as these are recorded. |

## OBJECTIVE 3 : Maximise local employment and business opportunities associated with the construction phase

It is acknowledged that skilled personnel are required for the construction of the wind turbines and associated infrastructure. However, where semi-skilled and unskilled labour is required, opportunities for local employment should be maximised as far as possible.

| | |
|---|---|
| **Project component/s** | » wind turbines;<br>» access roads;<br>» substation;<br>» power line; and<br>» service buildings. |
| **Potential Impact** | » The opportunities and benefits associated with the creation of local employment and business should be maximised. However, due to the relatively small size of the facility the number of employment and business opportunities for locals will be limited. |
| **Activities/risk sources** | » The employment of outside contractors to undertake the work and who make use of |

| | |
|---|---|
| | their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities. |
| **Mitigation: Target/Objective** | » Developer, in discussions with the local municipality, should aim to employ as many workers (skilled, semi-skilled / low-skilled) from the local areas/ towns, as possible.<br>» Developer should develop a database of local BEE service providers |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Employ as many workers (skilled, semi-skilled / low-skilled) from the local area/ nearby towns. | Contractors | Construction |
| Implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local employment target is met. | Contractors | Where required, training and skills development programmes to be initiated prior to the initiation of the construction phase. |
| Develop a database of local BEE service providers and ensure that they are informed of relevant tenders and job opportunities. | Contractors | Database of potential local BEE services providers to be completed before construction phase commences. |
| Identify potential opportunities for local businesses. | Contractors | Tender Design and Review stage |

| | |
|---|---|
| **Performance Indicator** | » Source as many local labourers as possible.<br>» Database of potential local BEE services providers in place before construction phase commences. |
| **Monitoring and Reporting** | » Contractors and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

**OBJECTIVE 4 : Avoid the negative social impacts on family structures and social networks due to the presence of construction workers**

While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including an increase in alcohol and drug use, an increase in crime levels, the loss of girlfriends and or wives to construction workers, an increase in teenage and unwanted pregnancies, an increase in prostitution and an increase in sexually transmitted diseases.

The potential risk to local family structures and social networks is, however, likely to be low. The low and semi-skilled workers are likely to be local residents and will therefore from part of the local family and social network.

| | |
|---|---|
| **Project component/s** | » Construction of wind turbines<br>» Construction work force |
| **Potential Impact** | » The presence of construction workers who live outside the area and who are housed in |

| | |
|---|---|
| | local towns can impact on family structures and social networks.<br>» Presence of construction workers on site may result in loss of livestock due to stock theft and damage to farm infrastructure, such as gates and fences. Poaching of wild animals may also occur.<br>» Due the relatively small number of workers associated with the construction of the proposed facility, the risk of impacts is likely to be low. |
| **Activities/risk sources** | » The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities.<br>» The presence of construction workers on the site can result in stock thefts and damage to farm infrastructure. |
| **Mitigation: Target/Objective** | » Avoid and or minimise the potential impact of construction workers on the local community and livelihoods. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Establish contact with the adjacent farmers and develop a Code of Conduct for construction workers.<br><br>Ensure that construction workers attend a brief session before they commence activities. The aim of the briefing session is to inform them of the rules and regulations governing activities on the site as set out in the Code of Conduct.<br><br>Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct. | Contractors | Briefing session for construction workers held before they commence work on site. |
| Ensure that construction workers who are found guilty of breaching the Code of Conduct are dealt with appropriately. Dismissals must be in accordance with South African labour legislation. | Contractors | Construction |
| No housing of construction workers on the site to be permitted, apart from security personnel. | Contractors | Construction |
| Compensate farmers / community members for any proven cost for any losses, such as livestock, damage to infrastructure etc. | Contractors | Compensate Farmers / community after a claim has been verified by the Developer or Contractors. |

| | |
|---|---|
| **Performance Indicator** | » Employment policy and tender documents that set out requirement for local employment and targets completed before construction phase commences.<br>» Code of Conduct developed and approved prior to commencement of construction phase.<br>» Labour locally sourced, where possible.<br>» Tender documents for contractors include recommendations for construction camp.<br>» All construction workers made aware of Code of Conduct within first week of being employed.<br>» Briefing session with construction workers held at outset of construction phase. |
| **Monitoring and Reporting** | » The Developer and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

| | |
|---|---|
| | » Public complaints register must be developed and maintained on site. |

## OBJECTIVE 5 : Noise control

Various construction activities would be taking place during the development of the facility and may pose a noise risk to sensitive receptors. While the study undertaken in the EIA investigated likely and significant noisy activities, it did not evaluate all potential activities that could result in a noise impact, as these were not defined at the time of the study. Other construction activities not evaluated could include temporary or short-term activities where small equipment is used (such as the digging of trenches to lay underground power-cables).

| | |
|---|---|
| **Project component/s** | List of project components affecting the objective:<br>» Construction of turbine system (foundation, tower, nacelle and rotor);<br>» Substation;<br>» access roads; and<br>» Power lines. |
| **Potential Impact** | » Nuisance noise from construction activities affecting the surrounding community. |
| **Activity/risk source** | » Any construction activities taking place within 500 m from potentially sensitive receptors (PSR). |
| **Mitigation: Target/Objective** | » Ensure equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors.<br>» Ensure as far as possible that maximum noise levels at potentially sensitive receptors be less than 65 dBA.<br>» Prevent the generation of a disturbing or nuisance noises.<br>» Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors.<br>» Ensuring compliance with the Noise Control Regulations. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| The construction crew must abide by the national standards and local by-laws regarding noise. | Contractor | Construction |
| All construction equipment, including vehicles, must be properly and appropriately maintained in order to minimise noise generation. | Contractor | Construction |
| Establish a line of communication and notify all stakeholders and sensitive receptors of the means of registering any issues, complaints or comments. | Environmental Control Officer | All phases of project. |
| Notify potentially sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 m) of the PSR is to start. The following information to be presented in writing:<br>» Description of activity to take place;<br>» Estimated duration of activity;<br>» Working hours; and<br>» Contact details of responsible party. | Contractor, Environmental Control Officer | At least 2 days, but not more than 5 days before activity is to commence. |

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| **Performance Indicator** | » No complaints received concerning noise.<br>» Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors.<br>» Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA as far as possible. |
| **Monitoring and Reporting** | » Should a compliant about noise be reported, the developer to look into the matter and determine steps to deal with the complaint. An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

## OBJECTIVE 6 : Management of dust and emissions and damage to roads

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

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| **Project component/s** | Project components affecting the objective:<br>» wind turbines;<br>» access roads;<br>» substation; and<br>» power line. |
| **Potential Impact** | » Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads. |
| **Activities/risk sources** | » The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads. |
| **Mitigation: Target/Objective** | » To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and also minimise damage to roads. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Implement appropriate dust suppression measures on site such as wetting roads on a regular basis. | Contractor | Construction |
| Haul vehicles moving outside the construction site carrying material that can be wind-blown should be covered with tarpaulins. | Contractor | Duration of contract |
| Ensure vehicles adhere to speed limits on public roads and speed limits set within the site by the ECO. Vehicles should be fitted with recorders to record when vehicles exceed the speed limit. | Contractor/ transportation contractor | Duration of contract |
| Disturbed areas must be re-vegetated as soon as practicable after construction is complete in an area. | Contractor | At completion of the construction phase. |
| Vehicles and equipment must be maintained in a road-worthy condition at all times. | Contractor | Prior to construction phase. |
| Ensure that damage to gravel public roads and access roads attributable to construction vehicles is repaired before completion of construction phase. | Contractor | Before completion of construction phase. |
| Regular dust control of materials (sand, soil, cement) must be used at concrete batching plants on site. | Contractor | Construction |

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| **Performance Indicator** | » Appropriate dust suppression measures implemented on site during the construction phase.<br>» Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed.<br>» All heavy vehicles equipped with speed monitors before they are used in the construction phase.<br>» Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis. |
| **Monitoring and Reporting** | » Developer and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.<br>» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

**OBJECTIVE 7 : Soil and rock degradation and erosion control**

The natural soil on the site needs to be preserved as far as possible to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern in areas underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion). Uncontrolled run-off relating to construction activity (excessive wetting, etc.) will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems. Steep slope are prone to soil erosion and good soil management must be undertaken during construction.

A set of strictly adhered to mitigation measures are required to be implemented in order to effectively limit the impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below. Management of erosion will be required during the construction phase of the facility. An erosion management plan is required to ensure compliance with applicable regulations and to prevent increased soil erosion and sedimentation of the downstream environment. The section below provides a guideline for the management of erosion on site and will need to be supplemented with the principles for erosion management contained in the Erosion Management Plan included in Appendix A.

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| **Project component/s** | Project components affecting the objective:<br>» wind turbines;<br>» access roads;<br>» substation;<br>» power line;<br>» Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas); andAll other infrastructure. |
| **Potential Impact** | » Erosion and soil loss;<br>» Negative impacts on wetlands; |

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| | » Disturbance to or loss of wetland/pan habitat;<br>» Sedimentation of watercourses/wetland areas;<br>» A loss of indigenous vegetation cover; and<br>» Increased runoff into drainage lines can potentially be associated with accelerated erosion. |
| **Activities/risk sources** | » Rainfall and wind erosion of disturbed areas;<br>» Excavation, stockpiling and compaction of soil;<br>» Concentrated discharge of water from construction activity;<br>» Stormwater run-off from sealed surfaces;<br>» Mobile construction equipment movement on site;<br>» Power line construction activities;<br>» River/stream/drainage line road crossings;<br>» Roadside drainage ditches; and<br>» Project related infrastructure, such as buildings, turbines and fences. |
| **Mitigation: Target/Objective** | » To minimise erosion of soil from site during construction;<br>» To minimise deposition of soil into drainage lines;<br>» To minimise damage to vegetation by erosion or deposition;<br>» To minimise damage to rock, soil and vegetation by construction activity;<br>» No accelerated overland flow related surface erosion as a result of a loss of vegetation cover;<br>» No reduction in the surface area of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure;<br>» Minimal loss of vegetation cover due to construction related activities;<br>» No or insignificant loss of wetland area in the specialist study area;<br>» No increase in runoff into drainage lines as a result of construction of project related infrastructure; and<br>» No increase in runoff into drainage lines as a result of road construction. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines and wetlands. Limit the height of stockpiles as far as possible to reduce compaction. | Contractor | During site establishment and any activity related to earthworks as well as the duration of construction. |
| New access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil. | Engineer / ECO / Contractor | Before and during construction |
| Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. | Contractor | Construction |
| Rehabilitate disturbance areas as soon as construction in an area is completed. | Contractor | During and after construction |
| Stockpiles not used in three (3) months after stripping must be seeded or appropriately covered to prevent dust and erosion - only if natural seeding does not occur. | Contractor | During and after construction |
| Erosion control measures: Implement run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets or temporary mulching over denuded | Contractor | Erection: Before construction<br>Maintenance: Duration of contract. |

| Mitigation: Action/control | Responsibility | Timeframe |
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| areas. | | |
| Particular care should be taken in the design of road drainage line and wetland crossings in order to ensure there is no step in the channel bed, substrate continuity is maintained and no undue constriction of flow takes place. | Contractor | Erection: during site establishment Maintenance: for duration of contract. |
| Where access roads cross natural drainage lines or wetlands, culverts (or other appropriate measures) must be designed to allow free flow. Regular maintenance of the culverts must be carried out. | Engineer / ECO / Contractor | Before and during construction |
| Control depth of all excavations and stability of cut faces/sidewalls. | Engineer / ECO / Contractor | Maintenance over duration of contract |
| Compile a comprehensive stormwater management plan as part of the final design of the project and implement during construction and operation. | Construction team, management, environmental control officer | Compile during design; implement during construction & operation |
| Cement batching to take place in designated areas only, as approved by the ECO (if applicable). | Contractor | Construction. |
| Spillages of cement to be cleaned up immediately and disposed or re-used in the construction process. | Contractor | Construction |
| Spill kits to be kept on active parts of the construction site & at site offices. | Contractor | Construction |
| Soil erosion control measures (such as hessian mats and gabions) be used for in erosion prone areas such as steep slopes. | Contractor | Construction |

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| **Performance Indicator** | » Acceptable level of activity within disturbance areas, as determined by ECO;<br>» Acceptable level of soil erosion around site, as determined by ECO;<br>» Acceptable level of increased siltation in drainage lines, as determined by ECO;<br>» Acceptable level of soil degradation, as determined by ECO; and<br>» Acceptable state of excavations, as determined by ER & ECO. |
| **Monitoring and Reporting** | » Continual inspections of the site by ECO;<br>» Fortnightly inspections of sediment control devices by ECO;<br>» On-going inspections of surroundings, including drainage lines and wetlands by ECO;<br>» Reporting of ineffective sediment control systems and rectification as soon as possible;<br>» An incident reporting system must record non-conformances to the EMPr; and<br>» Public complaints register must be developed and maintained on site. |

## OBJECTIVE 8 : Limit disturbance and avoid damage to wetland areas and drainage lines

The layout for the wind energy facility avoids the placement of turbines (such as the substation) within wetland areas. However, there are still some instances where roads and cables may cross identified wetland or watercourse areas. Mitigation measures are required to minimise impacts on those systems affected in this regard.

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| **Project component/s** | List of project components affecting the objective:<br>» access roads;<br>» cabling; and<br>» power line. |
| **Potential Impact** | » Damage to wetland areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the wetland as a natural system. |
| **Activity/risk source** | » Construction of access roads, cabling and power line. |
| **Mitigation: Target/Objective** | » No damage to wetlands and drainage lines within project area. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Align underground cables and internal access roads as far as possible along existing infrastructure and disturbances. | Project Company, Contractor, ECO | Construction |
| Ensure overhead power lines are constructed to span watercourse crossings so as to reduce impacts on riparian vegetation. | Project Company, Contractor, | Construction |
| For any new construction where direct impacts on wetlands are unavoidable cross watercourses perpendicularly to minimise disturbance footprints. | Project Company, Contractor, | Construction |
| Rehabilitate any disturbed areas as soon as possible once construction is completed in an area. | Project Company, Contractor, | Construction |
| Obtain required water use license for impacting on wetlands (if applicable). | Project Company | Pre-construction |
| Construction must not result in the width of the watercourse being narrowed. | Contractor | Construction |
| Control stormwater and runoff water. | Contractor | Construction |
| Where identified by the ECO, utilise erosion control measures on access roads, wetland areas and drainage lines. | Contractor | Construction |
| Concrete batching plants and stockpiles to be located more than 500m away from wetlands. | Contractor | Construction |

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| **Performance Indicator** | » Limited impacts on water quality, water quantity, riparian or wetland vegetation, natural status of riparian or wetland areas. |
| **Monitoring and Reporting** | » Habitat loss in watercourses should be monitored before and after construction.<br>» The ECO should be responsible for driving this process and reporting.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

## OBJECTIVE 9 : Protection of indigenous vegetation and control of alien invasive plants

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. Due to disturbance of vegetation, there is a higher risk of alien species dominating disturbed areas. Therefore, control of alien invasive plants is required. An Alien Invasive Plant Management Plan is attached to Appendix B. Method for Plant Rescue and Habitat Rehabilitation (a Plant Rescue and Re-Vegetation Management Plan) is attached to Appendix C.

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| **Project component/s** | List of project components affecting the objective:<br>» wind turbines and associated laydown areas;<br>» access roads and cabling;<br>» substation;<br>» workshop area;<br>» batching plants;<br>» temporary laydown areas; and<br>» powerline and associated access road. |
| **Potential Impact** | » Proliferation of alien plants |
| **Activity/risk source** | » Site preparation and earthworks;<br>» Construction-related traffic;<br>» Foundations;<br>» Mobile construction equipment;<br>» Power line construction activities; and<br>» Dumping or damage by construction equipment outside of demarcated construction areas. |
| **Mitigation: Target/Objective** | » To retain natural vegetation in the highly sensitive areas of the site;<br>» To minimise footprints of disturbance of vegetation/habitats on-site;<br>» No alien plants within project control area; and<br>» No loss of species of conservation concern. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Unnecessary impacts on surrounding natural vegetation must be avoided, e.g. driving around in the veld. The construction impacts must be contained to the footprint of the infrastructure. | Contractor and ECO, management (ECO) | Construction |
| Internal access roads and cables should be aligned as far as possible along existing linear disturbances, e.g. roads on site and away from steep slopes and drainage lines as much as possible. Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas as far as possible. | Contractor and ECO | Construction / design |
| Identify and demarcate areas within which activities are to be undertaken. Ensure that activities are restricted to these areas to ensure unnecessary impacts on surrounding natural vegetation are avoided. | Contractor and ECO | Construction |
| Establish an on-going monitoring programme to detect, quantify and remove any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act, Act 43 of 1983 and NEM: Biodiversity Act). | Contractor and ECO | Construction & Operation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Control any alien plants that become established using registered control methods. | Contractor and ECO | Construction & Operation |

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| **Performance Indicator** | » Limited disturbance outside of designated work areas.<br>» Minimised clearing of existing/natural vegetation.<br>» Limited loss of natural vegetation within "no-go" areas. Loss of other natural vegetation only within designated footprint of infrastructure.<br>» Limited fragmentation of untransformed areas of natural vegetation.<br>» Limited alien infestation within project control area. |
| **Monitoring and Reporting** | » Observation of vegetation clearing activities by ECO throughout construction phase.<br>» Supervision of all clearing and earthworks.<br>» Monitoring of alien plant establishment within the project control area on an on-going basis.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

**OBJECTIVE 10 : Protection of fauna & avifauna**

Infrastructure associated with the facility often impacts on birds and animals. Furthermore, the construction and maintenance of the power line linking the facility to the electricity grid will result in some disturbance and habitat destruction. New roads constructed will also have a disturbance and habitat destruction impact.

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| **Project component/s** | List of project components affecting the objective:<br>» wind turbines and ;associated laydown areas;<br>» access roads and cabling;<br>» substation;<br>» workshop area;<br>» batching plants;<br>» temporary laydown areas; and<br>» power lines and associated access road. |
| **Potential Impact** | » Vegetation clearance and associated impacts on faunal habitats; and<br>» Disturbance of birds |
| **Activity/risk source** | » Site preparation and earthworks;<br>» Construction-related traffic;<br>» Foundations or plant equipment installation;<br>» Mobile construction equipment; and<br>» Power line construction activities. |
| **Mitigation: Target/Objective** | » To minimise footprints of habitat destruction; and<br>» To minimise disturbance to resident and visitor faunal and avifaunal species. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Any overhead power lines which are built, and which are above ground and are 132kV or lower, should use a "bird | Project Company and Contractor | During construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| friendly" monopole structure, fitted with a bird perch, as per Eskom standard guidelines | | |
| The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted. | Contractor | Site establishment & duration of contract. |
| Should any animals be found these should be relocated prior to constriction | Contractor | Site establishment & duration of contract. |
| Should any bird nests be found these should be relocated | Contractor | Site establishment & duration of contract. |
| Np poaching or hunting of wildlife on site during construction | Contractor | Site establishment & duration of contract. |

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| **Performance Indicator** | » Minimum disturbance outside of designated work areas.<br>» Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna.<br>» Limited impacts on faunal species (i.e. noted/recorded fatalities), especially those of conservation concern. |
| **Monitoring and Reporting** | » Observation of vegetation clearing activities by ECO throughout construction phase.<br>» Supervision of all clearing and earthworks by ECO.<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

## OBJECTIVE 11 : Protection of fossils and sites of heritage and archaeological value

The construction phase of the wind energy facility will entail excavations into the superficial sediment cover (soils etc.) and perhaps also into the underlying bedrock. Areas of potentially fossiliferous bedrock may be sealed-in or sterilised by infrastructure such as hard standing areas for each wind turbine, lay down areas and internal access roads. These activities may adversely affect potential fossil heritage within the study area by potentially damaging, destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

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

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| **Project component/s** | List of project components affecting the objective:<br>» wind turbines;<br>» access roads and cabling;<br>» Operations and service building area;<br>» Substation; and<br>» power line and associated access roads. |

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| **Potential Impact** | » Heritage objects or artefacts found on site are inappropriately managed or destroyed; and<br>» Loss of fossil resources. |
| **Activity/risk source** | » Site preparation and earthworks;<br>» Foundations or plant equipment installation;<br>» Mobile construction equipment movement on site;<br>» Power line construction activities;<br>» Access road construction activities; and<br>» Substation construction facilities. |
| **Mitigation: Target/Objective** | » To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. | Project Company | Pre-construction |
| If a heritage object is found, work in that area must be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes. | Project Company / Contractor in consultation with Specialist | Duration of contract |
| If at any stage during the construction phase any semblance of a fossil were to be observed, it would be vital to recover the fossil and report the occurrence to the geological staff at the closest repository in the Northern Cape and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken. | Contractor | Duration of contract |
| If concentrations of archaeological materials are exposed during construction then all work must stop for an archaeologist to investigate. | Contractor | Construction |
| If any human remains (or any other concentrations of archaeological heritage material) are exposed during construction, all work must cease and it must be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency, so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material. | Contractor | Construction |
| If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Albany Museum (046 622 2312) and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken. | Contractor | Construction |
| Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the | Contractor | Construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| procedures to follow when they find sites. | | |
| Monitoring of all substantial bedrock excavations for fossil remains by EO, with reporting of new finds to SAHRA and / or a professional palaeontologist for possible specialist mitigation (i.e. recording, judicious sampling of fossil material). | EO Developer | Construction |

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| **Performance Indicator** | » Minimum disturbance outside of designated work areas.<br>» All heritage items located are dealt with as per the legislative guidelines. |
| **Monitoring and Reporting** | » Observation of excavation activities by ECO throughout construction phase.<br>» Supervision of all clearing and earthworks.<br>» An incident reporting system will be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

## OBJECTIVE 12 : Minimisation of visual impacts associated with construction

During construction heavy vehicles, components, cranes, equipment and construction crews will frequent the area and may cause, at the very least, a visual nuisance to landowners and residents in the area as well as road users.

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| **Project component/s** | List of project components affecting the objective:<br>» Construction site;<br>» access roads; and<br>» turbines. |
| **Potential Impact** | » The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation; and<br>» Construction traffic. |
| **Activity/risk source** | » The viewing of visual scarring by observers in the vicinity of the facility or from the roads traversing the site. |
| **Mitigation: Target/Objective** | » Minimal disturbance to vegetation cover in close vicinity to the proposed facility and its related infrastructure; and<br>» Minimised construction traffic, where possible. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| The general appearance of construction activities, construction equipment camps and lay-down areas must be maintained and kept neat and tidy by means of the timely removal of rubble and disused construction materials. | Contractor | Construction |
| The turbines must be painted a pale, , non-reflective colour (i.e., as specified by CAA) before erection of the turbines. | Contractor | Erection of turbines |
| Limit access to the construction sites (during both construction and operational phases) along existing access roads as far as possible. | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Ensure all disturbed areas are appropriately rehabilitated once construction in an area is complete. | Contractor | Duration of construction |

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| **Performance Indicator** | » Construction site maintained in a neat and tidy condition.<br>» Vegetation cover that remains intact with no erosion scarring in close proximity of the facility.<br>» Site appropriately rehabilitated after construction is complete. |
| **Monitoring** | » Monitoring of vegetation clearing during the construction phase.<br>» Monitoring of rehabilitation activities to ensure appropriate rehabilitation of the site.<br>» An incident reporting system will be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

**OBJECTIVE 13 : Appropriate handling and storage of chemicals, hazardous substances and waste**

The construction phase of the wind energy facility will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility will include general solid waste, hazardous waste and liquid waste although in very small amounts.

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| **Project component/s** | List of project components affecting the objective:<br>» wind turbines;<br>» substation;<br>» power line; and<br>» Concrete batching plant. |
| **Potential Impact** | » Release of contaminated water from contact with spilled chemicals;<br>» Generation of contaminated wastes from used chemical containers;<br>» Inefficient use of resources resulting in excessive waste generation; and<br>» Litter or contamination of the site or water through poor waste management practices. |
| **Activity/risk source** | » Vehicles associated with site preparation and earthworks;<br>» Power line construction activities;<br>» Substation construction activities;<br>» Packaging and other construction wastes;<br>» Hydrocarbon use and storage ; and<br>» Spoil material from excavation, earthworks and site preparation. |
| **Mitigation: Target/Objective** | » To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons;<br>» To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons;<br>» To comply with waste management legislation;<br>» To minimise production of waste;<br>» To ensure appropriate waste storage and disposal; and<br>» To avoid environmental harm from waste disposal. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| An effective monitoring system must be implemented during the construction phase to detect any leakage or | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| spillage of hazardous substances during their transportation, handling, use and storage. | | |
| The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files, as defined by the ECO. | Contractor | Duration of contract |
| Any spills will receive the necessary clean-up action. Bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan). | Contractor | Duration of contract |
| Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be complied with. | Contractor | Duration of contract |
| Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils. | Contractor | Duration of contract |
| Transport of all hazardous substances must be in accordance with the relevant legislation and regulations. | Contractor | Duration of contract |
| Waste disposal records must be available for ECO review at all times. | Contractor | Duration of contract |
| Construction contractors must provide specific detailed waste management plans to deal with all waste streams. | Contractor | Duration of contract |
| Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control. | Contractor | Duration of contract |
| Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc.). | Contractor | Duration of contract |
| Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors and licensed waste disposal sites. | Contractor | Duration of contract |
| Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area. | Contractor | Duration of contract |
| Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal. | Contractor | Duration of contract |
| Documentation (waste manifest) must be maintained | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| detailing the quantity, nature and fate of any hazardous waste. | | |
| An incident/complaints register must be established and maintained on-site. | Contractor | Duration of contract |
| Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered. | Contractors | Erection: during site establishment Maintenance: for duration of Contract within a particular area. |
| All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site. | Contractors | Erection: during site establishment Maintenance: for duration of Contract within a particular area. |
| Supply waste collection bins at construction equipment and construction crew camps. | Contractors | Erection: during site establishment Maintenance: for duration of Contract within a particular area. |
| Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised. | Contractor | Duration of contract |
| All stored fuels to be maintained within a bund and on a sealed surface. | Contractor | Duration of contract |
| Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function. | Contractor | Duration of contract |
| Construction machinery must be stored in an appropriately sealed area. | Contractor | Duration of contract |
| Oily water from bunds at the substation must be removed from site by licensed contractors. | Contractor | Duration of contract |
| Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. | Contractor | Duration of contract |
| Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. | Contractor | Duration of contract |
| In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. Spill kits to be kept on-site. | Contractor | Duration of contract |
| Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility. | Contractor | Duration of contract |
| Upon the completion of construction, the area will be cleared of potentially polluting materials. | Contractor | Completion of construction |

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

## OBJECTIVE 14 : Ensure disciplined conduct of on-site contractors and workers

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

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| **Project component/s** | » Wind energy facility; and<br>» Associated infrastructure. |
| **Potential Impact** | » Pollution/contamination of the environment; and<br>» Disturbance to the environment and surrounding communities. |
| **Activity/risk source** | » Contractors are not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment. |
| **Mitigation: Target/Objective** | » To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| This EMPr and the Environmental Authorisation must be included in all tender documentation and Contractors contracts. | Developer | Tender process |
| Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting must be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors. Ablution facilities must not be placed within 50m from any river, wetland or drainage line. | Contractor (and sub-contractor/s) | Duration of contract |
| Cooking must take place in a designated area. No | Contractor (and sub- | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| firewood or kindling may be gathered from the site or surrounds. | contractor/s) | |
| All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste. | Contractor (and sub-contractor/s) | Duration of contract |
| No one other than the ECO or personnel authorised by the ECO, will disturb flora or fauna outside of the demarcated construction area/s. | Contractor (and sub-contractor/s) | Duration of contract |

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| **Performance Indicator** | » Compliance with specified conditions of Environmental Authorisation, EIA report and EMPr;<br>» No complaints regarding contractor behaviour or habits; and<br>» Code of Conduct drafted before commencement of construction phase and briefing session with construction workers held at outset of construction phase. |
| **Monitoring and Reporting** | » Observation and supervision of Contractor practices throughout construction phase.<br>» A complaints register must be maintained, in which any complaints from the community are to be logged. Complaints must be investigated and, if appropriate, acted upon as soon as possible.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

**OBJECTIVE 15 : To avoid and or minimise the potential risk of increased veld fires during the construction phase.**

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| **Project component/s** | » wind turbines<br>» construction camp |
| **Potential Impact** | » Fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. |
| **Activity/risk source** | » Contractors are not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment. |
| **Mitigation: Target/Objective** | » To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Ensure that open fires on the site for cooking or heating are not allowed except in designated areas. | Contractor | Construction |
| Provide adequate fire fighting equipment on-site. | Contractor | Construction |
| Provide fire-fighting training to selected construction staff. | Contractor | Construction |
| Compensate farmers / community members at full market related replacement cost for any losses due to the wind energy facility project, such as livestock, damage to infrastructure etc. | Contractor | Construction |

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| **Performance** | » Designated areas for fires identified on site at the outset of the construction phase. |

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| **Indicator** | » Fire fighting equipment and training provided before the construction phase commences.<br>» Compensation claims settled after claim verified by independent party. |
| **Monitoring** | » A complaints register must be maintained, in which any complaints from the community are to be logged. Complaints must be investigated and, if appropriate, acted upon.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

**OBJECTIVE 16 : Traffic management and transportation of equipment and materials to site (Traffic Management Plan)**

The construction phase of the project will be the most significant in terms of generating traffic impacts resulting from the transport of equipment (including turbine components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the Wind Energy Facility and ancillary infrastructure) and external works outside the site boundary.

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

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Develop and implement a transportation/traffic management Plan. | Contractor, (Transportation sub-contractor) | Duration of contract |
| All relevant permits for abnormal loads must be applied for from the relevant authority. | Contractor, (Transportation sub-contractor) | Duration of contract |
| A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit. | Contractor | Duration of contract |
| Appropriate road management strategies must be Implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures. | Contractor, (Transportation sub-contractor) | Duration of contract |
| Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities. | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards). | Contractor | Duration of contract |
| Appropriate maintenance of all vehicles must be ensured. | Contractor | Duration of contract |
| All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license. | Contractor | Duration of contract |
| Keep hard road surfaces as narrow as possible. | Contractor | Duration of contract |

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| **Performance Indicator** | » No traffic incidents involving Project personnel or appointed contractors;<br>» Appropriate signage in place; and<br>» No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the Wind Energy Facility. |
| **Monitoring** | » Visual monitoring of dust produced by traffic movement;<br>» Visual monitoring of traffic control measures to ensure they are effective;<br>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon; and<br>» An incident reporting system will be used to record non-conformances to the EMPr. |

**OBJECTIVE 17 : Effective management of concrete batching plants**

Concrete is required during the construction of a wind energy facility. In this regard there could be a need to establish a batching plant within the site. Batching plants are facilities/installations that combine various ingredients to form concrete. Some of these inputs include sand, water, aggregate (rocks, gravel, etc.), fly ash, potash, and cement.

Turbid and highly alkaline wastewater, dust emissions and noise are the key potential impacts associated with concrete batching plants. Concrete batching plants, cement, sand and aggregates can produce dust. Potential pollutants in batching plant wastewater and stormwater include cement, sand, aggregates, chemical additive mixtures, fuels and lubricants.

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| Project component/s | » Concrete batching plant/s |
| Potential Impact | » Dust emissions<br>» Release of contaminated water<br>» Generation of contaminated wastes from used chemical containers<br>» Inefficient use of resources resulting in excessive waste generation |
| Activity/risk source | » Operation of the batching plant<br>» Packaging and other construction wastes<br>» Hydrocarbon use and storage<br>» Spoil material from excavation, earthworks and site preparation |
| Mitigation: | » To ensure that the operation of the batching plant does not cause pollution to the |

| Target/Objective | environment or harm to persons |
|---|---|

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Where possible concrete batching plants should be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised | Contractor | Construction phase |
| The provision of natural or artificial wind barriers such as trees, fences and landforms may help control the emission of dust from the plant. | Contractor | Construction phase |
| Where there is a regular movement of vehicles. Access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment | Contractor | Construction phase |
| The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up | Contractor | Construction phase |
| The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind. | Contractor | Construction phase |
| Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and reduce water usage | Contractor | Construction phase |
| Conveyors must be designed and constructed to prevent fugitive dust emissions. This may include covering the conveyor with a roof, installing side protection barriers and equipping the conveyor with spill trays, which direct material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage. | Contractor | Construction phase |
| The site should be designed and constructed such that clean stormwater, including roof runoff, is diverted away from contaminated areas and directed to the stormwater discharge system. | Contractor | Construction phase |
| Any liquids stored on site, including admixtures, fuels and lubricants, should be stored in accordance with applicable legislation | Contractor | Construction phase |
| Contaminated stormwater and process wastewater should be captured and recycled where possible. A wastewater collection and recycling system should be designed to collect contaminated water. | Contractor | Construction phase |
| Process wastewater and contaminated stormwater collected from the entire site should be diverted to a settling pond, or series of ponds, such that the water can be reused in the concrete batching process. The settling pond or series of ponds should be lined with an impervious liner capable of containing all | Contractor | Construction phase |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| contaminants found within the water they are designed to collect | | |
| Areas where spills of oils and chemicals may occur should be equipped with easily accessible spill control kits to assist in prompt and effective spill control | Contractor | Construction phase |
| Ensure that all practicable steps are taken to minimise the adverse effect that noise emissions. This responsibility includes not only the noise emitted from the plant and equipment but also associated noise sources, such as radios, loudspeakers and alarms | Contractor | Construction phase |
| Where possible, waste concrete should be used for construction purposes at the batching plant or project site. | Contractor | Construction phase |
| The batching plant should be monitored by the ECO to ensure that the plant is operating according to its environmental objectives and within legislative requirements. | ECO | Construction phase |

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| Performance Indicator | » No complaints on dust<br>» No water or soil contamination by chemical spills<br>» No complaints received regarding waste on site or indiscriminate dumping |
| Monitoring | » Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase<br>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon<br>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon<br>» An incident reporting system will be used to record non-conformances to the EMPr<br>» Developer or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase |

## 5.4. Detailing Method Statements

**OBJECTIVE 18 : Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk**

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

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

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

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed in the method statement: pre, during and post construction includes:

- Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and to be established etc. Including a site camp plan indicating all of these).
- Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.
- Batching procedures
- Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions)

- Stipulate the storm water management procedures recommended in the storm water management method statement.
- Ablution facilities (placement, maintenance, management and servicing)
- Solid Waste Management:
  - Description of the waste storage facilities (on site and accumulative).
  - Placement of waste stored (on site and accumulative).
  - Management and collection of waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - The design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
  - Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed of, link into an existing facilities where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into wetlands or natural watercourses.
- Dust and noise pollution
  - Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
  - Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
  - Lists of all potentially hazardous substances to be used.
  - Appropriate handling, storage and disposal procedures.
  - Prevention protocol of accidental contamination of soil at storage and handling areas.
  - All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- Fire prevention and management measures on site.
- Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary).
  - Rehabilitation and re-vegetation process.
- Incident and accident reporting protocol.
- General administration
- Designate access road and the protocol on while roads are in use.
- Requirements on gate control protocols.

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

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The ECO must monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

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

**OBJECTIVE 19 : To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm**

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

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document.
- Employees will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
- Employees must undergo training for the operation and maintenance activities associated with a wind energy facility and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course which can be done by the contractors environmental representative or the ECO.
- The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.
- Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
- Records must be kept of those that have completed the relevant training.
- Training should be done either in a written or verbal format but must be in an appropriate format for the receiving audience.
- Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.

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

**OBJECTIVE 20 : To monitor the performance of the control strategies employed against environmental objectives and standards**

An environmental monitoring programme should be developed and implemented not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of environmental monitoring will most likely be stipulated by the Environmental Authorisation.

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

- Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications;
- Ensure adequate and appropriate interventions to address non-compliance;
- Ensure adequate and appropriate interventions to address environmental degradation;
- Provide a mechanism for the lodging and resolution of public complaints;
- Ensure appropriate and adequate record keeping related to environmental compliance;
- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site; and
- Aid communication and feedback to authorities and stakeholders.

The Environmental Control Officer (ECO) will ensure compliance with the EMPr during construction, and will conduct monitoring activities on a regular basis. An independent ECO must be appointed, and have the appropriate experience and qualifications to undertake the necessary tasks. The ECO will report any non-compliance or where corrective action is necessary to the Site Manager, DEA and/or any other monitoring body stipulated by the regulating authorities.

# CHAPTER 6: MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: REHABILITATION OF DISTURBED AREAS

## 6.1. Overall Goal for the Rehabilitation of Disturbed Areas

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

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

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

**OBJECTIVE 21 : To ensure rehabilitation of disturbed areas**

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations.

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| **Project component/s** | List of project components affecting the objective:<br>» wind energy facility (including temporary access roads and laydown areas);<br>» power line servitude and service road for power line servitude;<br>» substation; and<br>» temporary laydown areas. |
| **Potential Impact** | » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention. |
| **Activity/risk source** | » Temporary laydown areas;<br>» Temporary access roads/tracks; and<br>» Other disturbed areas/footprints. |
| **Mitigation: Target/Objective** | » To ensure and encourage site rehabilitation of disturbed areas; and<br>» To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| A site rehabilitation programme must be compiled and implemented. | Contractor in consultation with Specialist | Duration of contract |
| All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of. | Contractor | Following execution of the works. |
| All temporary fencing and danger tape should be removed once the construction phase has been completed. | Contractor | Following completion of construction activities in an area. |
| Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion. | Contractor | Following completion of construction activities in an area. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use native/indigenous plant species removed from disturbance areas in the rehabilitation phase. | Contractor in consultation with rehabilitation specialist | Following completion of construction activities in an area. |
| Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved. | Developer in consultation with rehabilitation specialist | Post-rehabilitation |
| On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis. | Developer in consultation with rehabilitation specialist | Post-rehabilitation |

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| **Performance Indicator** | » All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities;<br>» Topsoil replaced on all areas and stabilised;<br>» Disturbed areas rehabilitated and at least 50% plant cover achieved on rehabilitated sites; and<br>» Closed site free of erosion and alien invasive plants. |
| **Monitoring and Reporting** | » On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented.<br>» On-going alien plant monitoring and removal should be undertaken on an annual basis.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

# CHAPTER 7: MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: OPERATION

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of wind energy facility's Operations Manager, and Environmental Manager for the operation phase of this project are detailed below.

The **Power Station Manager** must:

» Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
» Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
» Take appropriate action as a result of findings and recommendations in management reviews and audits.
» Provide forums to communicate matters regarding environmental management.

The **Environmental Manager** must:

» Develop and Implement an Environmental Management System (EMS) for the wind energy facility and associated infrastructure.
» Manage and report on the facility's environmental performance.
» Maintain a register of all known environmental impacts and manage the monitoring thereof.
» Conduct internal environmental audits and co-ordinate external environmental audits.
» Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA) on environmental performance and other issues.
» Conduct environmental training and awareness for the employees who operate and maintain the wind energy facility.
» Compile environmental policies and procedures.
» Liaise with interested and affected parties on environmental issues of common concern.
» Track and control the lodging of any complaints regarding environmental matters.

## 7.1. Overall Goal for Operation

**Overall Goal for Operation:** To ensure that the operation of the wind energy facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the wind energy facility in a way that ensures that operation activities are properly managed in respect of environmental aspects and impacts and enables the wind energy facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, farming practices, traffic and road use, and effects on local residents as well as minimising impacts on birds and other fauna using the site.

## 7.2. Objectives

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

**OBJECTIVE 22 : Securing the site**

Safety issues may arise with public access to wind turbines (e.g. unauthorised entry to the site) or to the wind farm substation. Prevention and control measures to manage public access are therefore important.

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| **Project component/s** | Project components affecting the objective:<br>» wind energy facility development footprint;<br>» access roads;<br>» substation;<br>» power line; and<br>» Operations and service building. |
| **Potential Impact** | » Hazards to landowners and public |
| **Activities/risk sources** | » Uncontrolled access to the wind energy facility and associated infrastructure. |
| **Mitigation: Target/Objective** | » To secure the site against unauthorised entry; and<br>» To protect members of the public/landowners/residents. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Where necessary to control access, fence and secure access to the site and entrances to the site. | Contractor | Operation |
| Post information boards about public safety hazards and emergency contact information. | Contractor | Operation |

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| **Performance Indicator** | » Site is secure and there is no unauthorised entry; and<br>» No members of the public/ landowners injured. |
| **Monitoring and Reporting** | » Regular visual inspection of fence for signs of deterioration/forced access<br>» An incident reporting system must be used to record non-conformances to the EMPr.<br>» Public complaints register must be developed and maintained on site. |

**OBJECTIVE 23 : Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation**

Indirect impacts on vegetation and terrestrial fauna during operation could result from maintenance activities and the movement of people and vehicles on site. In order to ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

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| **Project component/s** | » Route of the security team.<br>» Areas disturbed during the construction phase and subsequently rehabilitated at its |

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|---|---|
| | completion. |
| **Potential Impact** | » Disturbance to or loss of vegetation and/or habitat.<br>» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention. |
| **Activity/Risk Source** | » Movement of employee vehicles within and around site. |
| **Mitigation: Target/Objective** | » Maintain minimised footprints of disturbance of vegetation/habitats on-site.<br>» Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation. |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Vehicle movements must be restricted to designated roadways. | Contractor | Operation |
| Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways. | Contractor | Operation |
| An on-going alien plant monitoring and eradication programme must be implemented, where necessary. | Contractor | Operation |
| A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis. | Contractor/Specialist | Annual monitoring until successful re-establishment of vegetation in an area |

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| **Performance Indicator** | » No further disturbance to vegetation or terrestrial faunal habitats.<br>» Continued improvement of rehabilitation efforts. |
| **Monitoring** | » Observation of vegetation on-site by environmental manager.<br>» Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas. |

## OBJECTIVE 24 : Protection of avifauna and priority bird species

During operation of the facility, the threat of collision of birds with the turbine blades and overhead power lines is considered to be of moderate to low significance for this facility. Four seasons of bird monitoring has been conducted and turbines have been removed from high risk areas. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of wind turbines in South Africa with which bird interactions have been monitored. Bird monitoring must be undertaken during the operation of the facility. A proposed bird monitoring programme for the operational phase is attached to Appendix D.

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| **Project component/s** | List of project components affecting the objective:<br>» wind energy facility (turbines);<br>» power lines ; and<br>» Substation. |
| **Potential Impact** | » Disturbance to or loss of birds as a result of collision with the turbine blades;<br>» Electrocution and collision with the power lines; |
| **Activity/risk source** | » Spinning turbine blades; |

| | |
|---|---|
| | » Unmarked overhead power lines; and<br>» Substation. |
| **Mitigation: Target/Objective** | » More accurately determine the impact of the operating wind energy facility on priority bird species; and<br>» Minimise impacts associated with the turbines, power lines and substation. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Some mitigation options that can be employed if monitoring reveals significant numbers of collisions. Mitigation measures should be considered in detail at that time, if needs be. | Project Company<br>Environmental Manager<br>Suitably qualified specialist | Operation |
| An operational phase monitoring programme must be implemented to survey bird movements in relation to the wind energy facility and fully document collision and electrocution casualties with the turbines and associated power lines. | Project Company<br>Environmental Manager<br>Suitably qualified specialist | Operation |
| Review bird monitoring report on the full year of operational bird monitoring, and integrate findings into operational EMPr and broader mitigation scheme. | Suitably qualified person/ advising specialist/ in consultation with Developer | 1 year post-construction |

| | |
|---|---|
| **Performance Indicator** | » Limit additional disturbance to bird populations on the wind energy facility site.<br>» Continued improvement of bird protection devices, if any.<br>» Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and the proposed/ operating wind energy facility.<br>» Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from pre-construction to operational phase. |
| **Monitoring and Reporting** | » Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades.<br>» Environmental manager to monitor turbine field for fatalities.<br>» Review of bird monitoring report on the full year of post-construction monitoring |

## OBJECTIVE 25 : Protection of Bats

Bats have been found to be particularly vulnerable to being killed by wind turbines. Pre-construction bat monitoring has been completed for all 4 seasons for the project development site. A proposed bat monitoring programme for the operational phase is attached to Appendix E.

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| **Project component/s** | List of project components affecting the objective<br>» access roads;<br>» substation; and<br>» wind turbines. |
| **Potential Impact** | » Bat mortality and destruction of habitat / roosts. |

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|---|---|
| **Activity/risk source** | » Wind turbine placement |
| **Mitigation: Target/Objective** | » Reduce impacts on bat species |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Implement a bat monitoring programme during the operational phase of the wind energy facility. | Project Company | Operational Phase |
| Implement any feasible mitigation measures for bats based on the operational phase bat monitoring if required. Further mitigation options that may be utilized include curtailment, blade feathering, blade lock, acoustic deterrents or light lures. | Project Company and Contractor and specialist | Operational Phase |
| Currently the most effective method of mitigation, after correct turbine placement, is alteration of blade speeds and cut-in speeds under environmental conditions favourable to bats.<br>A basic "4 levels of mitigation" (by blade manipulation or curtailment), from light to aggressive mitigation:<br>1. No curtailment (free-wheeling is unhindered below manufacturers cut in speed so all momentum is retained, thus normal operation).<br>2. 90 Degree feathering of blades below manufacturers cut-in speed so it is exactly parallel to the wind direction as to minimize free-wheeling blade rotation as much as possible without locking the blades.<br>3. 90 Degree feathering of blades below mitigation cut in conditions.<br>4. 90 Degree feathering throughout the entire night.<br><br>Preliminarily, it is recommended that curtailment mitigation initiates at Level 1 then depending on the results of the post construction mortality monitoring, which must be initiated when the first turbine is turning, the mitigation can be intensified up to a maximum intensity of Level 4 should it be necessary based on post construction monitoring. This is an adaptive mitigation management approach that will require changes in the mitigation plan to be implemented immediately and in real time during the post construction monitoring. | Project Company and Contractor and specialist | Operational Phase |

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| **Performance Indicator** | » No additional disturbance to bat populations on the wind energy facility site.<br>» Continued improvement of bat protection devices, if any.<br>» Regular provision of clearly worded, logical and objective information on the interface between the bat populations and the proposed/ operating wind energy facility.<br>» Clear and logical recommendations on why, how and when to institute mitigation measures to reduce bat impacts of the development, from pre-construction to |

| | |
|---|---|
| | operational phase. |
| **Monitoring and Reporting** | » Environmental manager to monitor turbine field for fatalities. |

**OBJECTIVE 26 : Minimisation of visual impact – lighting**

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The potential for mitigation is therefore low or non-existent.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous flashing lights on the turbines representing the outer perimeter of the facility. In this manner less warning lights can be utilised to delineate the facility as one large obstruction, thereby lessoning the potential visual impact. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered too, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis. The operational, security and safety lighting fixtures of the proposed wind energy facility will have some impact on telescopic observations from the Southern African Large Telescope (SALT), located 35km to the north east of the site, on the plateau. The SALT relies on keeping ambient lighting levels to a minimum in order to maximise its operational potential.

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| **Project component/s** | List of project components affecting the objective:<br>» Wind energy facility (including access roads);<br>» Power lines; and<br>» Substation. |
| **Potential Impact** | » Risk to aircraft in terms of the potential for collision; and<br>» Enhanced visual intrusion. |
| **Activity/risk source** | » Substation and associated lighting; and<br>» Wind turbines and other infrastructure. |
| **Mitigation: Target/Objective** | » To minimise potential for visual impact;<br>» To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft; |

| | |
|---|---|
| | » Minimise contrast with surrounding environment and visibility of the turbines to humans; and<br>» The containment of light emitted from the substation in order to eliminate the risk of additional night-time visual impacts. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Aviation warning lights must be mounted on turbine hub or such measures required by the Civil Aviation Authority. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous flashing lights on the turbines representing the outer perimeter of the facility. | Contractor and Turbine supplier, instructed by Project Company | Duration of contract |
| Maintain the general appearance of the facility in an aesthetically pleasing way. | Contractor | Operation and maintenance |
| Ensure that proper planning is undertaken regarding the placement of lighting structures for the substation and that light fixtures only illuminate areas inside the substation site. | Contractor | Operation and maintenance |
| Undertake regular maintenance of light fixtures. | Contractor | Operation and maintenance |

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| **Performance Indicator** | » Appropriate visibility of infrastructure to aircraft.<br>» The effective containment of the light to the substation sites. |
| **Monitoring and Reporting** | » Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times.<br>» The monitoring of the condition and functioning of the light fixtures during the operational phase of the project. |

## OBJECTIVE 27 : Minimisation of noise impacts from turbines

From the results of the EIA studies undertaken, noise impacts associated with the wind energy facility are expected to be of low significance. However, mitigation measures are proposed in order to further reduce any potential for noise impact. The rating level in the area for the wind energy facility is likely to be 35 dBA at night. That would also be the "lower limit". Due to the limited noise receptors in and around the site (as identified in the noise impact assessment report), noise from the turbine is unlikely to negatively affect any residents in the broader study area.

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|---|---|
| **Project component/s** | List of project components affecting the objective:<br>» Wind energy facility (including access roads). |
| **Potential Impact** | » Increased noise levels at potentially sensitive receptors;<br>» Changing ambient sound levels could change the acceptable land use capability; and<br>» Disturbing character of sound. |
| **Activity/risk source** | » Wind turbines |
| **Mitigation: Target/Objective** | » Ensure that the change in ambient sound levels (measured in $L_{Aeq}$) as experienced by Potentially Sensitive Receptors is less than 5 dBA; (change from the measured and calculated ambient sound levels for the corresponding wind speed); |

| | |
|---|---|
| | » Prevent the generation of disturbing noise from the wind turbines; and<br>» Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Design and implement a noise monitoring programme for the operational phase if required. Define the ambient sound levels in 10 minute bins over a period of at least 7 days before the operational phase starts inside. 10 minute sampling bins should be co-ordinated with 10 m wind speed. | Project Company / Acoustical Consultant / Approved Noise Inspection Authority | To be determined by Project Company |
| If required, additional noise monitoring points at a complainant that registered a valid and reasonable noise complaint relating to the operation of the facility | Project Company / Acoustical Consultant / Approved Noise Inspection Authority | To be determined on a case-by-case basis |
| A Noise Monitoring Programme should be designed by an acoustic consultant after discussions with the project developer and considering the comments from surrounding stakeholders if required. This may involve routine or response measurements. Measurements is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured at a 10 meter height. These samples should be collected when the Wind Turbines are operational. Monitoring is recommended for the first year, as well as any other NSDs that have complained to the developer regarding noise originating from the facility during it operation. | Acoustical Consultant / Approved Noise Inspection Authority | To be determined by Project Company |

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| **Performance Indicator** | » Ensure that the change in ambient sound levels ($L_{Aeq}$) as experienced by Potentially Sensitive Receptors is less than 7 dBA. |
| **Monitoring and Reporting** | » Noise monitoring programme to be developed and implemented at the start of operation. |

## OBJECTIVE 28 : Appropriate handling and management of hazardous substances and waste

The operation of the wind energy facility will involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste and hazardous waste.

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| **Project component/s** | List of project components affecting the objective:<br>» wind turbines;<br>» power line; and<br>» substation. |
| **Potential Impact** | » Inefficient use of resources resulting in excessive waste generation; and<br>» Litter or contamination of the site or water through poor waste management practices. |
| **Activity/risk source** | » Generators and gearbox – turbines; |

| | |
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| | » Transformers and switchgear – substation; and<br>» Fuel and oil storage. |
| **Mitigation: Target/Objective** | » To comply with waste management legislation;<br>» To minimise production of waste;<br>» To ensure appropriate waste disposal; and<br>» To avoid environmental harm from waste disposal. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Hazardous substances must be stored in sealed containers within a clearly demarcated designated area. | Contractor | Operation |
| Storage areas for hazardous substances must be appropriately sealed and bunded. | Contractor | Operation |
| All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling. | Contractor | Operation |
| Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation. | Contractor | Operation and maintenance |
| Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor. | Contractor / waste management contractor | Operation |
| Used oils and chemicals:<br>» Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority.<br>» Waste must be stored and handled according to the relevant legislation and regulations. | Contractor | Operation |
| General waste must be recycled where possible or disposed of at an appropriately licensed landfill. | Contractor | Operation |
| Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately. | Contractor | Operation |
| Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. | Contractor | Operation |
| No waste may be burned or buried on site. | Contractor | Operation |

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| **Performance Indicator** | » No complaints received regarding waste on site or dumping;<br>» Internal site audits identifying that waste segregation, recycling and reuse is occurring appropriately;<br>» Provision of all appropriate waste manifests; and<br>» No contamination of soil or water. |
| **Monitoring and** | » Waste collection must be monitored on a regular basis·. |

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|---|---|
| **Reporting** | » Waste documentation must be completed and available for inspection on request;<br>» An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon; and<br>» Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports. |

## OBJECTIVE 29 : Maximise local employment and business opportunities during operation

A limited number of permanent employment opportunities will be created during the operational phase of the project. The operational phase is expected to last for 20 years.

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| **Project component/s** | List of project components affecting the objective:<br>» Wind energy facility; and<br>» Day to day operational activities associated with the wind energy facility including maintenance etc. |
| **Potential Impact** | » The opportunities and benefits associated with the creation of local employment and business should be maximised. |
| **Activity/risk source** | » The operational phase of the wind energy facility will create permanent employment opportunities.<br>» The establishment of a wind energy facility has the potential to create and attraction for visitors to the area. The development also has the potential to promote the benefits of renewable energy projects. |
| **Mitigation: Target/Objective** | » Create medium- to long-term full time employment for locals. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Identify local members of the community who are suitably qualified or who have the potential to be employed full time. | Contractor | Identify members during construction |
| Develop a training and skills transfer programme for the operational phase for local personnel. | Contractor | Operations |

| | |
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| **Performance Indicator** | » Public exposure to the project.<br>» Meeting with Local Municipality. |
| **Monitoring and Reporting** | » Indicators listed above must be met for the operational phase. |

## OBJECTIVE 30 : Ensure the implementation of an appropriate fire management plan during the operation phase

The vegetation in the study area may be at risk of fire. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

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| **Project Component/s** | » Operation and maintenance of the wind energy facility and associated infrastructure. |
| **Potential Impact** | » Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a very minor risk to the wind energy facility infrastructure. |
| **Activities/Risk Sources** | » The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires. |
| **Mitigation: Target/Objective** | » To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods. |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Provide adequate fire fighting equipment on site. | Contractor | Operation |
| Provide fire-fighting training to selected operation and maintenance staff. | Contractor | |
| Ensure that appropriate communication channels are established to be implemented in the event of a fire. | Contractor | Operation |
| Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.). Access roads may also act as fire breaks. | Contractor | Operation |
| Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency. | Contractor | Operation |
| Contact details of emergency services should be prominently displayed on site. | Contractor | Operation |

| | |
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| **Performance Indicator** | » Fire fighting equipment and training provided before the construction phase commences.<br>» Appropriate fire breaks in place. |
| **Monitoring and Reporting** | » Developer must monitor indicators listed above to ensure that they have been met. |

**OBJECTIVE 31 : Minimise the potential negative impact on farming activities and on the surrounding landowners**

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

Some positive impacts will be experienced with farmers gaining more access to land through the high quality site roads. Farmers involved with the project will also receive income which can be invested into farming activities. Once construction is completed, negative impacts on farming activities on the site must be limited as far as possible.

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| **Project Component/s** | » Possible negative impacts of activities undertaken on site on the activities of surrounding property owners; and<br>» Impact on farming activities on site. |
| **Potential Impact** | » Limited intrusion impact on surrounding land owners; and<br>» Interference with farming activities on site. |
| **Activities/Risk Sources** | » Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents, and<br>» Operational activities on site could interfere with farming activities of landowner. |
| **Mitigation: Target/Objective** | » Effective management of the facility;<br>» Mitigation of intrusion impacts on property owners; and<br>» Mitigation of impact on farming activities. |

| **Mitigation: Action/Control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Effective management of the facility and accommodation facility to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services. | Contractor | Operation |
| Vehicle movement to and from the site should be minimised as far as possible. | Contractor & Employees | Operation |
| Local roads should be maintained to keep the road surface up to a reasonable standard. | Contractor | Operation |
| Limit the development of new access roads on site. | Contractor | Operation |
| Ensure on-going communication with the landowners of the site in order to ensure minimal impact on farming activities. | Project Company and Contractor | Operation |

| | |
|---|---|
| **Performance Indicator** | » No environmental pollution occurs (i.e. waste, water and sanitation);<br>» No intrusion on private properties and on the activities undertaken on the surrounding properties; and<br>» Continuation of farming activities on site. |
| **Monitoring and reporting** | » Developer should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met. |

# CHAPTER 8: MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: DECOMMISSIONING

The turbine infrastructures which will be utilised for the proposed wind energy facility are expected to have a lifespan of 20 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered at any relevant and competent authority at that time.

## 8.1. Site Preparation

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

## 8.2 Disassemble Turbines

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

**OBJECTIVE 32 OBJECTIVE: To avoid and or minimise the potential environmental and social impacts associated with the decommissioning phase**

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|---|---|
| **Project component/s** | » wind turbines<br>» substation<br>» power lines |
| **Potential Impact** | » Impacts on people, flora, fauna, soils etc. |
| **Activity/risk source** | » Decommissioning of the Wind Energy Facility. |
| **Mitigation: Target/Objective** | » To avoid and or minimise the potential social impacts associated with decommissioning phase of the Wind Energy Facility. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Retrenchments should comply with South African Labour legislation of the day. | Contractor | Decommissioning. |
| Project Company must ensure that all relevant regulations, national and local legislation are adhered to and that the relevant authorities are informed and involved in the process as much as possible. | Project Company | Decommissioning |
| Rehabilitation should start immediately after decommissioning is completed. | Contractor | Decommissioning |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Re-vegetation specifications to be developed. | Contractor | Decommissioning |
| All excavations must be rehabilitated with soil and topsoil, which should not contain invasive plant species (in compliance with the CARA, as amended), to the satisfaction of the ECO. | Contractor | Decommissioning |
| All building materials must be removed from the site. All compacted surfaces must be ripped and re-vegetated as per the re-vegetation specifications. | Contractor | Decommissioning |
| The most suitable seed mix for disturbed areas to be used in rehabilitation would include indigenous species. | Contractor | Decommissioning |
| Rehabilitation to be conducted in a progressive manner (i.e. once decommissioning in an area has been completed the area will be rehabilitated). The rehabilitation of the area with indigenous vegetation must coincide with the rainfall events and all alien invasive vegetation shall be removed. | Contractor | Decommissioning |
| Rehabilitation measures for the site are to include the following:<br>» Re-contouring<br>Subsoil stockpiles should be used to re-contour construction affected areas. The Contractor shall restore the profile, soil condition and landform to as close as possible state to the pre-construction state.<br>» Scarification and ripping<br>All areas where rehabilitation interventions are required shall be cross-ripped before topsoil placement. Topsoil and fertile soil shall be uniformly scarified to allow for vegetation growth<br>» Fertilising<br>The Contractor shall be required to perform soil analysis tests on the top 75mm of prepared surface prior to re-vegetation/seeding to determine the required fertiliser levels for permanent cover.<br>» Seed acquisition<br>The Contractor shall purchase seed from a South African National Seed Organisation (SANSOR) accredited dealer. Seed used for rehabilitation shall not be older than one season. Purchased seed must be of the correct species and of known origin, dried and packed, conforming to all legal requirements for seed. Proof of compliance must be provided to Developer prior decommissioning of works. | Project Company and Contractor | Decommissioning |
| The Contractor shall schedule works for placing of topsoil once all infrastructure has been successfully decommissioned. Seeding can then take place after the first rains of the season and should be concluded by one month before the end of the growing season. | Contractor | Decommissioning |
| The seed mix for use in rehabilitation must be an approved mix of indigenous grass species common to the area. | Contractor | Decommissioning |
| The Contractor shall maintain rehabilitated areas free of weeds and invader plants until the end of the Defects Notification Period | Contractor | Decommissioning |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| applicable to rehabilitation. Control of weeds and invader plants must be done in accordance with the specifications stipulated in the CARA. | | |
| The Contractor shall be responsible for the prevention of erosion in areas impacted upon by their activities. All erosion repairs must be implemented at the first signs thereof and no erosion shall be allowed to develop on a large scale. | Contractor | Decommissioning |
| All recyclable rubble and solid waste (e.g. scrap metal, cables, bottles, cans, and plastic residues) shall be collected and disposed of through a registered recycling company. Waste manifests will be kept by the Contractor and shown to the ECO on request.<br>All non-recyclable rubble and solid waste shall be collected and disposed of at an approved waste disposal site. Waste manifests will be shown to the ECO on request. | Contractor | Decommissioning |

| | |
|---|---|
| **Performance Indicator** | » South African Labour legislation at the relevant time; and<br>» Successful re-vegetation and rehabilitation of the site |
| **Monitoring** | Monitoring of Rehabilitation by ECO b& Rehabilitation Close-Out Report. |

# CHAPTER 9: FINALISATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through surveys (flora, fauna, avifauna, bats, and heritage) and site development footprint, including the access roads and power line routes . This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

# APPENDIX I(A):

# EROSION MANAGEMENT PLAN

# PRINCIPLES FOR EROSION MANAGEMENT

## 1. Purpose

An Erosion Management Plan addresses the management and mitigation of significant impacts relating to soil erosion. The objective of the plan is to provide:

- A general framework for erosion management, which enables the contractor to identify areas where erosion can be accelerated from their action; and
- An outline of general methods to monitor, manage and rehabilitate erosion in ensuring that all erosion caused by this development is addresses.

## 2. Legislation and Standards

Soil conservation pertaining to erosion has been a topic within legislation form the 1930's till today in South Africa. Internationally, standards have been set by the International Finance Corporation and the World Bank to address soil erosion in construction and decommissioning of areas. Therefore this document will ensure that the developer meets the South African legislative requirements and the IFC standards with regards to monitoring, managing and rehabilitating soil erosion on the wind energy facility site.

Relevant legislation:

- Conservation of Agricultural Resources Act No 43 of 1983;
- Environmental Conservation Act No 73 of 1989;
- National Forestry Act No 84 of 1998;
- National Environmental Management Act No 107 of 1998; and
- The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.

## 3. Areas with a high soil erodability potential

The following areas are generally associated with high soil erodibility potential:

- Any areas without vegetation cover;
- Excavated areas;
- Steep areas;
- Areas where the soil has already been degraded ;
- Dispersive, duplexed soil areas;
- Areas with fine grained soil material with a low porosity;
- Areas which undergo overland flow of water;
- Areas close to water;
- Irrigated areas;

» Compacted areas;
» Rivers;
» Drainage lines;
» Any areas where developments cause water flow to accelerate on a soil surface; and
» Coarsely gravelly covered surfaces.

## 4. Precautionary management activities to avoid erosion

In the assessment process the ECO and the contractor must assess all:
» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerating soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

## 5. Monitoring

### 5.1. General Erosion

The ECO must assess the site for erosion indicators in the monitoring process, which include:

» Bare soil;
» Desiccation cracks;
» Terracettes;
» Sheet erosion;
» Rill erosion (small erosion features with the same properties and characteristics as gullies);
» Hammocking (Soil build-up);
» Pedestalling (Exposing plant roots);
» Erosion pavements;
» Gullies; and
» Evidence of Dispersive soils.

In the assessment process, the ECO and the contractor must assess all:

» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerated soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

If any activities or placement of equipment cause pooling on the site, degrade the vegetation, result in removal of the surface or subsurface soil horizons, create compacted surfaces with steep gradients, or minimise runoff areas, the erosion potential on the site will increase.
If any erosion features start forming or are present as a result of the activities mentioned above the ECO must:

- Assess the situation;
- Take photographs of the soil degradation;
- Determine the cause of the soil erosion;
- Inform and show the relevant contractors the soil degradation;
- Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan;
- Monitor that the contractor is taking action to stop the erosion and assist them where needed;
- Report and monitor the progress of the rehabilitation weekly and recorded all the findings in a site dialy; and
- All actions with regards to the incidents must be recorded in a monthly compliance report which will be submitted to the department.

The contractor/ developer (with the ECO's consultation) must:

- Select a system to treat the erosion;
- Design the treatment system;
- Implement the system;
- Monitor the area to see if the system functions like it should, if the system fails, the method must be adapted or adjust to ensure the accelerated erosion is controlled; and
- Monitoring must continue until the area has been stabilised.

## 5.2. Stormwater Management

The ECO is responsible for monitoring the site and the activities to ensure that no unnatural soil degradation is taking place. The ECO must assess the site for erosion indicators such as:

- Bare soil;
- Exposed plant roots, pedestalling;
- Sheet erosion;
- Rill erosion;
- Hammocking;
- Erosion pavements;
- Terracettes; and
- Gullies.

In the assessment process the ECO and the contractor must assess all:

- Disturbed watercourse areas by the development: roads, bridges, river crossings, cabling, permanent laydown areas, crane pads and any other remaining hard surfaces; and

» Construction activity limited to specified areas. Stockpiles of aggregate and material will be positioned at least 50 m away from drainage lines and wetlands.

If any erosion features are present as a result of the activities mentioned above the ECO must:

» Assess the situation;
» Take photographs of the soil degradation;
» Determine the cause of the erosion;
» Inform and show the relevant contractors the soil degradation;
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan;
» Monitor that the contractor is taking action to stop the erosion and assist them where needed;
» Monitor and document the rehabilitation process weekly; and
» All actions with regards to the incidents must be reported in the monthly compliance monitoring report.

The contractor/ developer must (with the ECO's consultation):

» Select a system to treat the erosion;
» Design the treatment system;
» Implement the system;
» Monitor the area to ensure that the erosion has been addressed adequately; and
» Monitor the soil rehabilitation process until the area has been stabilised.

## 6. Rehabilitation

The following erosion control measures and rehabilitation specifications must be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

## 6.1. General Erosion Management

This sections discussion addresses the equipment required to remediate erosion, the precautionary measures which must be taken to avoid erosion and mitigation requirements for already degraded areas.

### 6.1.1. Equipment

The civil works contractor may use the following instruments to combat erosion when necessary:
» Reno mattresses;
» Slope attenuation;
» Hessian material;
» Shade catch nets;
» Gabion baskets;
» Mulching Run-off control (increase the amounts of runoff areas to disperse the water);

- Silt fences;
- Storm water channels and catch pits;
- Shade / catch nets;
- Soil bindings;
- Geofabrics;
- Hydroseeding and/or re-vegetating;
- Mulching over cleared areas;
- Stone packing; and
- Tilling (roughing the surface).

### 6.1.2. Methods to prevent accelerated erosion

The following practises must be considered and adhered to:

- Ensure steep slopes are stabilised.
- Ensure that steep slopes are not stripped of vegetation and left to dry out and become water repellent (which will case increased runoff and a decreased infiltration rate) increasing the erosion potential.
- Ensure that all water on site (rain water or water wastage from the construction process) does not result in any surface flow (increase velocity and capacity of water) as a result of poor drainage systems.
- Ensure that pooling of water on site is avoided, as the site and the general area consists of dispersive soils, pooling will cause an increase of infiltration on one area, causing the subsurface to begin eroding.
- Ensure that heavy machinery does not compact those areas which are not intended to be compacted (i.e. areas intended to be managed), as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. Where compaction does occur, the areas should be ripped.
- Ensure that compacted areas have adequate drainage systems to avoid pooling and surface flow.
- Prevent the concentration or flow of surface water or stormwater down cut or fill slopes, or along pipeline routes or roads, and ensure measures to prevent erosion are in place prior to construction.
- Ensure that stormwater and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that surface flows are managed prior to being discharged back into a natural watercourse to support the maintenance of natural base flows within the ecological systems and prevent erosion, i.e. hydrological regime (water quantity and quality) is maintained.
- Ensure siltation and sedimentation through the use of the erosion equipment mentioned.
- Ensure that all stormwater control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local ground watertable in low quantities (to reduce runoff but prevent subsurface erosion).
- Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
- Ensure that vegetation clearing is conducted in parallel with the construction progress across the site to minimise erosion and/or run-off.

» Ensure that large tracts of bare soil which would cause dust pollution in high winds, or have high erosion susceptibility and increase sedimentation in the lower portions of the catchment are controlled through temporary surface covering.
» Ensure no diversion of water flows in catchment occurs.
» Ensure that dust control measures are implemented, but prevent over-wetting/ saturating the area (to cause pooling) and run-off (that may cause erosion and sedimentation).
» Watercourse (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing watercourses.

### 6.1.3. Mitigation for previously degraded areas

Previously degraded areas could pose a threat to construction activities in the area and must therefore be stabilised, then remediated and rehabilitated through:

» Protecting, stabilise and isolate the degraded areas to ensure no further damage is caused by erosion due to construction activities.
» Increase the drainage in the area but avoid pooling.
» Prevent increasing sedimentation in areas that have been chocked by soils from degraded areas.
» Once construction has been completed, a method statement must be drafted for the rehabilitation of the previously degraded areas, using equipment mentioned above and implemented.
» Stabilisation of steep slopes must be undertaken.
» Ensure that bare soil is covered and hydro seeded to reduce topsoil loss.

## 6.2. Methodologies

The following erosion control measures and rehabilitation specifications may be required to be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

» Topsoil covered with a geotextile or hessian material and a grass seed mixture (see Rehabilitation Specifications).
» Logging or stepping following the contours of the slope, to reduce surface runoff.
» Earth or rock-pack cut-off berms.
» Packed branches to roughen the surface and promote infiltration.
» Benches (sand bags).
» Stabilisation of near vertical slopes (1:1 – 1:2), if created during construction, will be required to utilise hard structures that have a natural look. The following methods may be considered:
  - Gabions (preferred method with geotextile material);
  - Retaining walls; and
  - Stone pitching.
» The slopes of all stream diversions must be protected. The following methods may be considered:
  - Reno mattresses (preferred method), ensure that the reno mattresses are buried deep into the subsurface, to avoid undercutting from the water;

- Coarse rock (undersize rip-rap);
- Sandbags; and
- Stone packing with geotextile.

» Where feasible use rubber dams as stream diversions when establishing water course crossings. Although (and considering that these are non-perennial watercourses) the recommendation is to construct watercourse crossings during dry periods (or no flow periods), where possible.
» Any concentration of natural water flow caused by road works or hardstands areas will be treated as follows:
  - if water flow is sub-critical, nothing is required; and
  - if water flow is supercritical, the outlets will be provided with protection (either gabions or stone pitching – depending on the flows) to release water subcritical back into the watercourse at a low velocity.

## 6.3. Engineering Specifications

A detailed Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers and this includes erosion control.

Requirements for project design:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» The location, area/extent (m²/ha) and specifications of all temporary and permanent water management structures or stabilisation methods.
» A resident Engineer to be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The Developer holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.
» Concrete lined drains placed adjacent to road to transfer the water to the existing water courses.
» Frequent gravel drains hydroseeded placed on permanent roadway edges.
» At the point where stormwater is discharged, energy dissipaters to be constructed to reduce the flow rate of run-off.
» All cut and fill banks will be seeded with an approved seed mix (as per the rehabilitation specifications) to ensure bank stabilisation and the elimination of potential erosion. Reno mattresses may be used to ensure that the area remains stable.

## 6.4. Rehabilitation Specifications

» Employ a Horticultural Landscape Contractor to fulfil the rehabilitation of disturbed areas post-construction.

» A detailed Rehabilitation Plan describing and illustrating the proposed rehabilitation activities on site must be prepared i.e. areas of top soiling, seeding and replanting of vegetation; species mix; requirements for fertilisation; seed sowing rates; watering etc. (i.e. bill of quantities).
» The following document should be consulted for further support with respect to information regarding rehabilitation, namely: The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
» These specifications may be modified by the Horticultural Landscape Contractor on consideration of site conditions.

## 6.5. Post- and during construction rehabilitation activities

» Correct and appropriate stockpile management of topsoil will be required during the construction phase.
» Rehabilitation of disturbed areas will be implemented as these areas become available for rehabilitation.
» Disturbed areas will include, for example: construction camp site, areas where underground cabling has been layed/buried, roadsides of new access roads.

# 7. Rehabilitation steps to mitigate the eroded areas

» Stockpiled topsoil must be spread over disturbed areas (150 – 200mm thick) just prior to planting/seeding.
» Rip and scarify along the contours of the newly spread topsoil prior to watering and seeding.
» Organic fertilizers or compost shall be used if site conditions require it and can be applied as part of hydro-seeding applications.
» Seed should be sown into weed-free topsoil that has been stockpiled (i.e. original topsoil from the site).
» Indigenous plants shall be used to rehabilitate disturbed areas.
» Applying the seed through hydromulching (hydro-seeding) is advantageous (or organic mulching after seeding).
» Watering is essential and rehabilitation should ideally occur during the wet season.
» The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.

## 7.1. 'Watering' to avoid erosion

» Movement of livestock in newly rehabilitated areas must be restricted, where possible, while taking into consideration drinking areas/paths.
» Watering the rehabilitated areas should be undertaken in the wet/rainy season essential but if this is not possible, an initial watering period (supplemental irrigation) will be required to ensure plant establishment (germination and established growth).

- Generous watering during the first two weeks, or until the seeds have germinated, is required (unless adequate rainfall occurs) i.e. seed beds will need to be kept moist for germination to occur.
- For grass to establish (once germination has occurred), rainfall or irrigation is needed at regular intervals, ideally every few days and possibly every day if weather conditions require it.
- During dry periods, with no rainfall, 100 litres per m² (or 100mm of rain) over a month or more, may be necessary to establish plants capable of surviving dry weather (or otherwise specified by the Horticultural Landscape Contractor).

## 7.2. Seeding

The developer should make use of an appropriate mix of grass species for rehabilitation (to be determined in consultation with a suitably qualified ecologist) and they must be mixed for sowing either in summer or in winter. Grass species application (Rutherford, 2006) is at the rate secified as kg/ha.

## 7.3. Steep slopes

- Areas that have a steep gradient and require seeding for rehabilitation purposes should be adequately protected against potential run-off erosion e.g. with coir geotextile netting or other appropriate methodology.
- Provision for wind should also be made on these slopes to ensure the fine grained soil is not removed.

## 7.4. Maintenance and duration

- Rehabilitation will occur during construction, as areas for plant rehabilitation become available.
- The rehabilitation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
- The rehabilitation phase (including post seeding maintenance) should be at least 6 months (depending on time of seeding and rainfall) to ensure establishment of plants with a minimum 80% cover achieved (excluding alien plant species).
- If the plants have not established and the 80% is not achieved within the specified maintenance period, maintenance of these areas shall continue until at least 80% cover is achieved (excluding alien plant species).
- Additional seeding may be necessary to achieve 80% cover.
- Any plants that die during the maintenance period must be replaced.
- Succession of natural plant species should be encouraged.

# 8. Conclusion

The Erosion Management Plan is a document to assist the contractor, the Developer and the ECO with guidelines on how to manage erosion. The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure comply with legislative

requirements. This document forms part of the EMP, and is required to be considered and adhered to during the design, construction, operation and decommissioning phases of the project.

## 9. References

Department of Environmental Affairs. (1983). *Conservation of Agricultural Resources Act 43 of 1983.* Pretoria: Department of Environmental Affairs.

Coetzee, K. (2005). *Caring for Natural Rangelands.* Scottsville: University of KwaZulu-Natal Press.

Commission, F. R. (2009, March 10). *Forestry Commission*. Retrieved August Tuesday, 2012, from Forestry Commission: Forest Research : www.forestry.gov.uk

Tongway, D. J., & Ludwig, J. A. (2004). *Heterogeneity in arid and semi arid lands.* Queensland: Sustainable Ecosystems.

van der Linde, M., & Feris, L. (2010). *Compendium of South African Legislation.* Pretoria: Pretoria University Press.

# APPENDIX I(B):

# ALIEN INVASIVE MANAGEMENT PLAN

# ALIEN INVASIVE PLANT MANAGEMENT PLAN

## OVERALL OBJECTIVE

Manage alien and invasive plant species during the construction and operation of the Wind Energy Facility, through the implementation of an alien invasive species management and control programme.

## 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. A list of declared weeds and invader plants is attached.

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 license 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.

## SPECIFIC MANAGEMENT OBJECTIVES:

- Ensure alien plants do not become dominant in parts or the whole landscape;
- Initiate and implement a monitoring and eradication programme for alien and invasive species;
- Control alien and invasive species dispersal and encroachment; and
- Promote the natural reestablishment and planting of indigenous species.

## 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.

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 natural and 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 should be checked for alien species more often than the surrounding landscape.

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 which created during construction which promotes the germination and establishment of alien plant species.

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.

## GENERAL CLEARING & GUIDING 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 preconstruction surveys of the development footprint. This may occur simultaneously to other required searches and surveys. The clearing plan must then form part of the preconstruction reporting requirements for the site.
- The plan should include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Dense mature stands of woody species where present must be left for last, as they probably will not increase in density or pose a greater threat than they are at the moment.
- Collective management and planning with neighbours may be required 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.

**CLEARING METHODS**

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

**USE OF HERBICIDES 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.
- Specific care must be taken to prevent contamination of any water bodies. This includes: due care in storage, application, cleaning of 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 used must have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighboring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

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

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

**ALIEN PLANT MANAGEMENT PLAN**

**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.

| Action | Frequency |
|---|---|
| The ECO is to provide permission prior to any vegetation being cleared for | Daily |

| | |
|---|---|
| development. | |
| Clearing of vegetation must be undertaken as the work front progresses – mass clearing is not allowed unless the entire cleared area is to be rehabilitated immediately. | Weekly |
| Should re-vegetation not be possible immediately, the cleared 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 may be sprayed with appropriate herbicides provided they break down when in contact with the soil. Residual herbicides should not be used. | Weekly |
| Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose must be brought onto site. Brush from cleared areas must be used as much as possible. Arid soils are usually very low in organic matter and the use of manure or other soil amendments is likely to encourage invasion. | Weekly |
| Clearing of vegetation must not be allowed within 50m of any wetland or pan, 80m 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 should be removed. | Weekly |
| Alien vegetation regrowth 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 DWAF Working for Water website. | Monthly |
| Clearing activities must be contained within the affected zones and may not spill over into demarcated No-Go areas. | Daily |
| Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only. | Monthly |
| Drainage lines and other sensitive areas must remain demarcated with appropriate fencing or hazard tape while construction activities within the area are underway. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities. | Daily |

**MONITORING – CONSTRUCTION PHASE**

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

| **Monitoring Action** | **Indictor** | **Timeframe** |
|---|---|---|

| | | |
|---|---|---|
| Document alien species present at the site | List of alien species | Preconstruction |
| Document alien plant distribution | Alien plant distribution map | 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 |

**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.

| Action | Frequency |
|---|---|
| Surveys for alien species must be conducted regularly. Every 3 months for the first two years after construction and biannually thereafter. All aliens identified must be cleared. | Every 3 months for 2 years and biannually thereafter |
| Re-vegetation with indigenous, locally occurring species must take place in areas where natural vegetation is slow to recover or where repeated invasion has taken place. | Biannually, but re-vegetation should take place at the start of the rainy season. |
| Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, 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 should be used. | When necessary |

**MONITORING – OPERATIONAL PHASE**

The following monitoring and evaluation actions must take place during the operational phase of the development.

| Monitoring Action | Indictor | Timeframe |
|---|---|---|
| Document alien species distribution and abundance over time at the site. | Alien plant distribution map. | Biannually |
| Document alien plant control measures implemented & | Records of control measures and their success rate. | Quarterly |

| | | |
|---|---|---|
| success rate achieved. | A decline in alien distribution and cover over time at the site. | |
| Document rehabilitation measures implemented and success achieved in problem areas. | Decline in vulnerable bare areas over time. | Biannually |

**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.

| 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 |

**MONITORING – DECOMMISSIONING PHASE**

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

| Monitoring Action | Indictor | 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. | Annually for 3 years |

| | | |
|---|---|---|
| | A decline in alien distribution and cover over time at the site | |

**REFERENCES:**

AGIS (2006) Weeds and Invasive Plants Atlas (www.agis.agric.za/wip)

# APPENDIX I(C):

# PLANT RESCUE AND PROTECTION PLAN

# METHODS FOR PLANT RESCUE AND RE-VEGETATION

## List of Abbreviations

**CARA:** Conservation of Agricultural Resources Act 43 of 1983
**DEA:** Department of Environmental Affairs
**EA:** Environmental Authorisation
**ECO:** Environmental Control Officer
**EMP:** Environmental Management Plan
**NEMA:** National Environmental Management Act 107 of 1998
**LFA:** Landscape Functional Analysis (Tongway and Hindley 2004)
**IAP:** Invasive Alien Plant

## List of Definitions:

**Accelerated soil erosion:** Soil erosion induced by human activities.

**Acceptable cover:** An acceptable cover shall mean that not less than 75% (in an area with rainfall above 400 mm per annum), or 40% (in regions receiving less than 400 mm rain per annum), of the area planted or hydroseeded shall be covered with grass and that there shall be no bare patches of more than 500 mm in maximum dimension.

**Alien:** Originating from another country or continent and originally different environment, commonly used to describe plants that are not indigenous to South Africa and have become problematic (spreading rapidly, threatening existing biodiversity).

**Allelopathic components:** One or more biochemical compound produced by a plant and released through leaf litter or roots that suppresses the growth, survival, and reproduction of other surrounding vegetation.

**Bare soil:** Un-vegetated soil surface, unaltered by humans.

**Compacted soil surface:** A soil surface that has been hardened by an outside source, causing the soil to be more compacted than the surrounding area.

**Container plants:** Container plants include all vegetation which are bought or supplied in acceptable containers from nurseries or vegetation lifted out of their natural position and placed in containers.

**Desirable end state:** The future condition or target on which the rehabilitation is designed and that will serve later as a basis for rehabilitation success evaluation. This can be based on a reference site or modelled according to available information on historic vegetation.

**Ecological rehabilitation:** The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that renders the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original historic state.

**Ecological restoration:** The process of assisting the recovery of an ecosystem that has been degraded damaged or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

**Ecosystem:** The combination of biota within a given area, together with a suitable environment that sustains the biota and the interactions between biota. It can have a spatial unit of any size, but

shows some degree homogeneity as far as structure, function and species composition is concerned. Small-scale ecosystems typically link up to larger scale ecosystems and all contribute to the ecosystem function and services at the landscape-scale.

**Establishment of grass:** All procedures necessary to produce an acceptable cover of grass on an area.

**Establishment Period:** The Establishment Period is defined as the period beginning from the actual planting or placing of vegetation until three months thereafter, unless otherwise specified or unless grass cover is unacceptable or unless plants have not taken.

**Extinction debt:** Is a concept that describes the future extinction of species due to events in the past. Extinction debt occurs because of time delays between impacts on a species, such as destruction of habitat or reduction of population size, and the species' ultimate disappearance.

**Geophytic:** Resprouting during the growing season from an underground storage organ such as bulbs, corms, tubers or rhizomes, and dying back completely during unfavourable seasons.

**Hydroseeding:** To apply seed in a slurry with water (plus other materials to enhance growth) by means of a spraying device.

**Indigenous:** Refers to a plant or animal that occurs naturally in the place in which it is currently found.

**Invasive plant:** Is a kind of plant which has under section 2 (3) of CARA been declared an invader plant, and includes the seed of such plant and any vegetative part of such plant which reproduces itself asexually.

**Landscape:** Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

**Nursery conditions:** These are the necessary conditions to maintain healthy growth of rescued and/or container plants. This includes protection of such plants against wind, frost, direct sunlight, pests, rodents, diseases, and drought. It also includes the provision of suitable water, fertilizer and any other measures required to maintain the container plants.

**Period of Maintaining:** The Period of Maintaining is defined as the period following directly after the Establishment Period until the end of the Period of Maintenance for the whole Contract as defined in the General Conditions of Contract, unless otherwise specified.

**Revegetation:** The process of establishing a vegetative cover on exposed soils, regardless of species composition or structure, as long as the species are non-invasive and their presence will not impede the gradual process of ecological rehabilitation or –restoration.

**Soil Erosion:** Is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and or physical transport on the land surface**.**

**Scarifying:** To roughen the surface of soil as a preparation for seeding or topsoil addition.

**Trimming:** To neatly round off the levels of existing or previously shaped earthworks to blend in with the levels of other earthworks, constructed works, or natural landforms.

**Transformation:** The conversion of an ecosystem to a different ecosystem or land use type.

**Topsoil:** Uppermost layer of soil, in natural vegetation maximally 30 cm, in cultivated landscapes the total depth of cultivation, containing the layer with humus, seeds and nutrients. Topsoils that are applied to landscapes to be rehabilitated must be free of refuse, large roots and branches, stones, alien weeds and/or any other agents that would adversely affect the topsoils suitability for re-vegetation.

**Weed:** A plant that grows where it is not wanted, and can therefore be an indigenous or alien species. An unwanted plant growing in a garden is just called a weed, but the 198 listed IAPs are called "declared weeds and invaders".

# 1. Purpose

The Plant Rescue and Revegetation Management 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 Storm Water and 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 EMP-related activities is consistent with the significance of project impacts.

# 2. Scope

This document is a plant rescue, rehabilitation, and revegetation plan that provides a guideline to be applied by all contractors on the development site. This plan, as part of the project EMPr, is a legally binding document that must be implemented to fullfil the requirements of relevant legislation. However, the management plan is an evolving guideline that needs to be updated or adapted as progress is made with the rehabilitation and revegetation of the project area, and successes and failures of procedures identified.

The objective of rescuing plants, rehabilitation and revegetation on the project area is to:

» 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.

# 3. Legislation and Standards

Relevant legislation:

- Conservation of Agricultural Resources Act 43 of 1983;
- Environmental Conservation Act 73 of 1989;
- National Forestry Act 84 of 1998;
- National Environmental Management Act 107 of 1998; and
- Northern Cape Nature Conservation Act (Act No. 9 of 2009).

## 4. Effect of clearing alien vegetation

Invasive and Alien Plants (IAPs) gradually displace and suppress indigenous and/or herbaceous vegetation as their stands become bigger and denser. In addition, they use more water, hence desiccate the soil more, and may alter chemical properties of the soil – partially through secondary compounds released from their litter, partially from compounds released from roots. These altered soils suppress the germination and establishment of herbaceous species, leading to bare soil underneath dense IAP canopies.

After clearing dense stands of invasive shrubs, soil surfaces are thus generally bare with topsoil exposed to erosion and often already somewhat capped and eroded.

## 5. Effect of removing individuals of 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.

## 6. General: 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.

## 6.1. Time of planting

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

## 7. General: IAP removal

Removal of invasive plants should at all times follow the specifications and guidelines of the Working for Water Programme (refer also to invasive plant management plan).

Information can be obtained from the relevant website:
http://www.dwaf.gov.za/wfw

Detailed information on clearing methods is available on the above websites "Alien Invasive Plants" menu (clearing methods, operational standards and species-specific treatment methods).

## 8. General: Rehabilitation and re-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.

## 8.1. Map and create management areas

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

» Current land cover
  - Roads and residential;
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable;
  - Transformed areas; 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 should be established to initiate rehabilitation after initial revegetation;
» approximate timeframes;
» monitoring protocol to evaluate success or failures of interventions;
  - establish permanently marked transects and monitor with fixed-point photography
» who will be responsible for doing what; and
» 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.

## 8.2. Setting realistic rehabilitation goals

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

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

» Stabilisation of soils;
» Stabilisation of riparian areas;
» Storm water reduction through management and wetland integrity;
» Clearing of IAPs;
    - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements; and
» 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.

## 8.3. 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 pan.
» Removal of all invasive vegetation – refer to the 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.

## 8.4. Initial revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

## 8.5. 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 operation standards.

## 8.6. Natural seed banks and improvement of plant structural and compositional diversity

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

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

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

The final vegetation cover must aim to 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); and
- Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

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

## 8.8. Timeframes and duration

- Rehabilitation must 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.

# 9. Conclusion

The Plant Rescue and Revegetation Management Plan is a document to assist the contractor and the developer with guidelines on how to plan and implement the required work, and understand the concepts behind successful rehabilitation. This plan will have to be implemented in conjunction with erosion-, storm water- and IAP management plans. The exact details of the rehabilitation plan will depend on the

determined extent of rehabilitation that will have to be undertaken, available funding, and desirable end state of the vegetation after rehabilitation.

## 10. References and further reading

Clewell, A., Rieger, J. and Munro, J. (2005). Guidelines *for Developing and Managing Ecological Restoration Projects, 2 Edition*. www.ser.org and Tucson: Society for Ecological Restoration International.

Coetzee, K. (2005). *Caring for Natural Rangelands.* Scottsville: University of KwaZulu-Natal Press.

Department of Environmental Affairs,(1983). *Conservation of Agricultural Resources Act 43 of 1983.* Pretoria: Department of Environmental Affairs.

Society for Ecological Restoration International Science & Policy Working Group. 2004. *The SER International Primer on Ecological Restoration*. www.ser.org & Tucson: Society for Ecological Restoration International.

Tongway, D.J. and Hindley, N.L. (2004) Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes, CSIRO Sustainable Ecosystems, CANBERRA, AUSTRALIA.

Tongway, D.J., Freudenberger, D.O., Noble, J.C., and Hodgkinson, K.C. (Eds). (2003). Landscape Ecology, Function and Management. CSIRO Sustainable Ecosystems, CANBERRA, AUSTRALIA.

# A. APPENDIX: RECOMMENDED OPERATIONAL STANDARDS

## OBJECTIVE: Revegetate and Rehabilitate disturbed areas

The Contractor must take all reasonable measures to ensure that plant species of conservation concern are rescued and survive indefinitely. Landscaped topsoils as well as areas cleared of IAPs must be adequately rehabilitated and /or revegetated to ensure that the ecosystems affected by the development regain and/or retain their functionality indefinitely.

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.

Mitigation measures relating to the vegetative cover as part of a healthy ecosystem must be implemented in order to effectively limit and gradually reverse the impact on the environment. The focus of the mitigation measures laid out below relate to project-related disturbances. Where such disturbances are exacerbated by farming-related disturbances or vice versa, mitigation measures must be carried out in consultation with the land-user responsible.

| | |
|---|---|
| **Project component/s** | Project components affecting the objective:<br>» Turbines;<br>» Access roads and cabling between and to turbine units;<br>» Power line;<br>» Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas);<br>» Substation; and<br>» All other infrastructure. |
| **Potential Impact** | » Loss of suitable substrate for a stable vegetation cover;<br>» De-stabilisation and/or alteration of substrate and hence degradation of vegetation cover, significant change in species composition or loss of agricultural potential;<br>» Loss of suitable habitat for flora and fauna;<br>» Leaky ecosystem due to loss of nutrients and moisture from the system, leading to a less resilient vegetation cover and loss of ecosystem function and –services;<br>» Degradation and/or loss of riparian areas and wetlands on and beyond the project boundaries;<br>» A loss of indigenous vegetation cover and possibly endangered species; and<br>» Disturbance of fauna species. |
| **Activities/risk sources** | » Rainfall and wind erosion of disturbed areas;<br>» Excavation, stockpiling and compaction of soil;<br>» Existing IAPs as well as clearing thereof;<br>» Concentrated discharge of water from construction activity or new infrastructure;<br>» Storm water run-off from sealed, altered or bare surfaces;<br>» Mobile construction equipment movement on site; |

| | |
|---|---|
| | » Cabling and access roads construction activities;<br>» Power line construction activities;<br>» River/stream/drainage line road crossings;<br>» Roadside drainage ditches;<br>» Project related infrastructure; and<br>» Premature abandonment of follow-up monitoring and adaptive management of rehabilitation. |
| **Mitigation: Target/ Objective** | » To minimise loss of plant species of conservation concern;<br>» To minimise unfavourable runoff conditions and loss of resources from the ecosystems;<br>» To minimise erosion of soil from site during and after construction;<br>» To minimise and mitigate unfavourable alteration to drainage lines, especially incision;<br>» To minimise damage to indigenous vegetation during and after construction;<br>» No accelerated overland flow related surface erosion as a result of project infrastructure;<br>» No reduction in the surface area or general nature and functionality of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure on the project areas and beyond its boundaries; and<br>» A clear reduction of IAPs on the project area and replacement thereof by indigenous vegetation according to a pre-determined desirable end state. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| **Planning** | | |
| Classify the entire project area into management units according to current land cover and state of the environment and map accordingly | Developer / Contractor | Prior to construction |
| For each management unit<br>» establish what interventions will be necessary relating to IAPs, soil erosion management, topsoil handling, landscape rehabilitation and revegetation;<br>» where rehabilitation and revegetation will be necessary, decide on the desired end state of vegetation for that management unit and create a list of species to be established on specific sites; and<br>» outline the management of construction activities, including topsoils, excavated materials and felled biomass in a manner that will optimise the rehabilitation goals as fast and as effective as possible for that management unit | Developer / Contractor in collaboration with ECO and land-users | Prior to construction |
| **Plant Rescue and indigenous plant materials** | | |
| All harvested plant materials shall be labelled with<br>» Genus as minimum, species if known; and.<br>» Habitat from which materials were collected | ECO | Prior to construction |
| Indigenous plant materials for re-vegetation:<br>» All plant material shall be obtained from the search-and-rescue operation on the site prior to clearing or from local nurseries or reputable seed providers.<br>» Indigenous materials shall only be removed from their habitat with the necessary permits whenever applicable.<br>» Each plant removed shall be handled, packed and stored | Contractor in collaboration with ECO | Before, during and after construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| in a manner suitable for that species.<br>» Removed plants shall be protected from windburn or other damage during transportation.<br>» No plants or plants with exposed roots shall be subjected to excessive exposure to drying winds and sun, or subjected to water logging.<br>» All plants shall be kept free from plant diseases and pests and protected from rodents or other damaging agents.<br>» All indigenous plants that have been removed prior to clearing shall be returned to conditions resembling their original habitat as close as practically possible. | | |
| Seed stocks for rehabilitation<br>» Seed can be used for cultivation of desirable species for revegetation.<br>» Seed shall be utilised for direct sowing or hydroseeding.<br>» Seed collected from the site must be dried and stored in a suitable facility under cool (7-10˚C), dry, insect free conditions until required for cultivation or seeding. Only viable, ripe seed shall be used.<br>» Seed harvested shall be insect- and pathogen free.<br>» Seed harvested shall not contain materials of any invasive species.<br>» Prior to clearing, seed shall be collected from the site on a regular basis as species start to seed to maximise the amount of fully developed seed secured.<br>» From sites that will be cleared, 100% of all seeds available may be collected.<br>» From sites adjacent to the development, 25% of seeds can be collected for rehabilitation. | Contractor and ECO | Before, during and after construction |
| Site-specific nursery<br>» On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for re-vegetation.<br>» Where nursery facilities can only cater for rescued plants, a suitable (local) nursery shall be identified that will be willing to receive seeds collected and propagate the necessary species for later revegetation.<br>» Soil or other propagation media, were used, shall be weed- and pathogen free.<br>» Argentine ants shall be controlled at all times.<br>» The area where plants are stored shall be kept free of weeds.<br>» Plants stored in the designated area shall be protected from rodents, excessive sun and wind, and inspected regularly until being planted for pathogens and pests, and then treated accordingly.<br>» The nursery shall be adequately secured to prevent loss or | Contractor, ECO to control | Prior to construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| theft of species. | | |
| Protected flora<br>» Ensure that no indigenous protected flora is removed from its original habitat in the project area without legal documents from the relevant authorities. | ECO | Before, during and after construction |
| **Topsoil** | | |
| Avoid<br>» Management units that will not be developed or selected elements – trees, rocky outcrops on site shall be maintained in situ and demarcated clearly to prevent any disturbance during construction.<br>» These units will be considered as NO-GO areas during construction. | Contractor and ECO | Before, during and immediately after construction |
| Invasives<br>» Remove all invasive shrubs as per the Working for Water specifications. | Contractor, ECO to control | Before, during and after construction |
| Mulch<br>» All trees felled shall be debranched and the logs used in controlling erosion from re-landscaped topsoils and/or adding surface roughness and organic matter to topsoils to be rehabilitated.<br>» All cut branches from trees, as well as all shrubs cleared from the construction site shall be shredded to mulch, either by a chipper or by hand to sticks no longer than 10 cm.<br>» Preparation of mulch shall be done at source<br>» Mulched material shall be free of seed-bearing invasive plant material<br>» The mulch shall be suitably stored – bagged if necessary - and will be used in rehabilitation and soil erosion management on the site<br>» Should additional mulch be used for rehabilitation, this must be obtained from invasive shrubs of areas not cleared<br>» Mulch shall be stored for as short a period as possible | Contractor, ECO to control | Before, during and immediately after construction |
| Storage of topsoil and subsoil:<br>» Topsoils constitute the upper 20 – 30 cm of soil only, lower layers of soil are regarded as subsoil.<br>» Stockpiling of topsoils and subsoils shall only be done on previously transformed areas, and be kept at least 50 m from any remaining natural vegetation.<br>» Care shall be taken during stockpiling to prevent the mixing of topsoil with subsoil and/or any other material.<br>» Topsoils shall be stored in heaps no higher than 100 cm, and shall be re-applied as soon as possible.<br>» Care shall be exercised during stockpiling of topsoils to prevent compaction thereof. | Contractor, ECO to control | During and immediately after construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| » Topsoils shall be adequately protected from erosion by preventing concentration of surface water and scouring of slopes.<br>» Erosion of topsoils has to be contained and repaired as soon as it occurs, before large scale erosion and loss of topsoil develops.<br>» Any logs obtained during clearing operations can be used in continuous rows to curtail erosion where necessary. Geojute (geotextile) shall be used additionally if the logs are not sufficient to remedy any erosion – for details refer to the erosion management plan.<br>» Where topsoils need to be stored longer than 6 months, such stockpiles shall be revegetated, even if this has to include re-seeding to achieve an acceptable cover of vegetation. | | |
| Boulders and rocks<br>» Where removed during clearing, should be stored separately and used in the rehabilitation program.<br>» Boulders and rocks must be partially buried within the topsoil layer wherever practical to provide greater soil-holding stability and reduce water erosion.<br>» Placement of rocks and boulders shall mimic the natural occurrence of rocks and boulders in the area. | Contractor, ECO to control | During and after construction |
| **Rehabilitation of surface** | | |
| Prior to the application of topsoil<br>» Subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures.<br>» Ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm.<br>» Compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil.<br>» Any rubbish, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place.<br>» Shaping will be to roughly round off cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes. | Contractor, ECO to control | During and after construction |
| Application of topsoil<br>» Topsoils shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed. | Contractor, ECO to control | During and after construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| » The final prepared surface shall not be smooth but furrowed to follow the natural contours of the land.<br>» The final prepared surface shall be free of any pollution or any kind of contamination.<br>» Care shall be taken to prevent the compaction of topsoil.<br>» Where applicable, the final prepared surface will also contain scattered rocks and/or logs to mimic the natural condition of the original habitat or area and to aid in soil stabilisation and erosion control. | | |
| Soil stabilisation<br>» Mulch from brush shall be applied by hand to achieve a layer of uniform thickness.<br>» Mulch shall be rotovated into the upper 10 cm layer of soil:<br>o this operation shall not be attempted if the wind strength is such as to remove the mulch before it can be incorporated into the topsoil<br>» In very rocky areas a layer of mulch shall be applied prior to adding the topsoil.<br>» Measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible:<br>o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed.<br>» Additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas:<br>o if mulch is limited, available mulch, together with harvested seeds, should be concentrated in these hollows to promote rapid re-vegetation in them<br>» Runnels or erosion channels developing shall be back-filled and restored to a proper condition:<br>o such measures shall be effected immediately before erosion develops at a large scale.<br>» Where erosion cannot be remedied with available mulch, logs or rocks, geojute shall be used to curtail erosion. | Contractor, ECO to control | During and after construction |
| Borrow-pits<br>» Shall be shaped to have undulating, low-gradient slopes and surfaces that are rough and irregular, suitable for trapping sediments and facilitation of plant growth.<br>» Upon completion of rehabilitation these reshaped and revegetated areas shall blend into the natural terrain. | Contractor, ECO to control | After construction |
| **Revegetation** | | |
| Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species:<br>» revegetation of the final prepared area is expected to | Contractor, ECO to control | Successively during construction, as construction of individual components is completed, then followed up |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| occur spontaneously to some degree where topsoils could be re-applied within 6 months; and<br>» revegetation will be done according to an approved planting/landscaping plan according to the management units initially delineated and their respective desirable end states and permissible vegetation. | | until desired end state is reached. |
| Re-seeding<br>» Revegetation can be increased where necessary by hand- seeding indigenous species:<br>o previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools.<br>» Re-seeding shall occur at the recommended time to take advantage of the growing season.<br>» In the absence of sufficient follow-up rains after seeds started germinating, watering of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seedbank.<br>» Where, after initial re-seeding, the no acceptable vegetation cover has established within 12 months, hydroseeding should be considered as an option for follow-up revegetation work.<br>» Sowing rates of seeds used during hydro-seeding should be obtained from the relevant supplier and in accordance with the existing environment. | Contractor, ECO to control | Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached. |
| Planting of species<br>» Species to be planted include all rescued species.<br>» The size of planting holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil.<br>» Soil around the roots of container plants shall not be disturbed.<br>» Bulbous plants shall be planted in groups or as features in selected areas.<br>» Before placement of larger plant specimens into prepared holes, the holes shall be watered if not sufficiently moist.<br>» During transplanting care shall be taken to limit or prevent damage to roots.<br>» Plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots. | Contractor, ECO to control | Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached |
| Traffic on revegetated areas<br>» Designated tracks shall be created for pedestrian of vehicle traffic where necessary.<br>» Disturbance of vegetation and topsoil must be kept to a | Contractor | Before, during and after construction |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| practical minimum, no unauthorised off road driving will be allowed.<br>» All livestock shall be excluded from revegetated areas. | | |
| Establishment<br>» The establishment and new growth of revegetated and replanted species shall be closely monitored.<br>» Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created. | Contractor | Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached |
| **Monitoring and follow-up treatments** | | |
| Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan:<br>» Erosion shall be monitored at all times and measures taken as soon as detected; and<br>» Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created. | ECO during construction, suitable designated person/institution after that | During and after construction, during operational and decommis-sioning phase |
| Weeding<br>» It can be anticipated that invasive species and weeds will germinate on rehabilitated soils:<br>o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate; and<br>o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications. | | |

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| **Performance Indicator** | » No activity in identified no-go areas;<br>» Acceptable level of activity within disturbance areas, as determined by ECO;<br>» Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist;<br>» The structural integrity and diversity of natural plant communities is recreated or maintained;<br>» Indigenous biodiversity continually improves according to the pre-determined desirable end state ;<br>o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state; and<br>» Ecosystem function of natural landscapes and their associated vegetation is improved or maintained. |
| **Monitoring** | » Fortnightly inspections of the site by ECO during construction<br>» An incident reporting system must record non-conformances to the EMPr.<br>» Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established:<br>o These inspections should be according to the monitoring protocol set out in the rehabilitation plan. |

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| | » Thereafter annual inspections according to the minimal monitoring protocol . |

# B. APPENDIX: CHECKLIST OF ACTIONS FOR REHABILITATION PLANNING

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| **Conceptual Planning** | » Identify rehabilitation site locations and its boundaries;<br>» Identify ownership of rehabilitation program;<br>» Describe improvements that are anticipated following rehabilitation;<br>» Identify the kind of ecosystem to be rehabilitated at each site;<br>» Identify rehabilitation goals and desirable end state;<br>» Identify physical site conditions in need of repair;<br>» Identify stressors in need of regulation or re-initiation to maintain the integrity of the ecosystem, such as aliens, erosion, fire-regime;<br>» Identify the list and kinds of interventions of abiotic and biotic interventions that are and will be needed;<br>» Identify landscape restrictions and whether or not its integrity is dependent on a functioning ecosystem outside the project area;<br>» Determine project funding and sources;<br>» Identify labour sources and equipment needs;<br>» Identify biotic resource needs and sources, e.g. suitable topsoil, seeds;<br>» Identify any permit requirements or other legal issues;<br>» Determine project duration; and<br>» Outline adaptable strategies for long-term protection and management. |
| **Preliminary Tasks** | » Appoint a rehabilitation practitioner who is in charge of all the technical aspects of rehabilitation;<br>» Appoint a restoration team and train where necessary to ensure effective implementation;<br>» Prepare a budget to accommodate the completion of preliminary tasks;<br>» Document existing site conditions, also describing biota;<br>» Conduct pre-project monitoring as needed, including soil chemistry, that may affect the success of the rehabilitation program;<br>» Establish a reference site or past reference that represents the desired end state of the site;<br>» Gather information on key species to be re-introduced;<br>» Conduct investigations as needed to assess the effectiveness of restoration methods and strategies used in similar habitats up to date;<br>» Decide if rehabilitation goals are realistic or need modification;<br>» Prepare a list of objectives that need to be reached to achieve restoration goals;<br>» Ensure liaison with affected stakeholders, especially as far as rehabilitation goals are concerned; and<br>» Investigate available accedes and infrastructure needed to facilitate implementation of rehabilitation. |
| **Implementation phase** | » Describe the interventions that will be implemented to attain each set objective;<br>» Acknowledge potential for passive restoration where viable;<br>» Prepare performance standards and monitoring protocols to measure the attainment of each objective;<br>» Schedule tasks needed to fulfil each objective;<br>» Obtain equipment, supplies and biotic resources as needed; and |

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| | » Prepare an appropriate budget. |
| **Implementation tasks** | » Mark boundaries and work areas;<br>» Install permanent monitoring fixtures; and<br>» Implement restoration tasks. |
| **Post-implementation tasks** | » Protect the rehabilitation site against initial disturbance, including herbivores;<br>» Perform post-implementation maintenance, especially continued monitoring and eradication of emerging IAPs; and<br>» Monitor site at least once per year, using the LFA technique, and identify needs for adaptive management. |
| **Evaluation** | » Assess monitoring data to determine whether performance standards are met and rehabilitation objectives reached and maintained; and<br>» Conduct an ecological evaluation of the newly completed rehabilitation. |

# C. APPENDIX: TRANSPLANTING GUIDELINES FOR PLANTS WITH UNDERGROUND STORAGE ORGANS

Many of the plants in harsh environments have underground storage organs from which they resprout every year after sufficient rains, flower and then die back soon after fruiting and remain dormant, out of sight until the next growing season. All species of the families Amaryllidaceae, Iridaceae, Orchidaceae are protected provincially, nationally and/or internationally, as are many species of other monocot species.

Root system: underground storage organs are variable in size, but usually between 15 and 40 cm deep in the soil.

Transplanting: success of transplanting is usually very high IF handled correctly.

Rescue 101: Plants should be lifted and transplanted after flowering and fruiting, preferably as the leaves start to die back. For lifting, loosen the soil or wedge apart rocks working from a circle of about 20 cm away from the base of the plant, working inwards but not closer than about 5 cm of the plant with a sharp narrow object such as a koevoet. Once the soil is loosened, gently feel by hand where the bulb, corm, or other storage organ is, and wedge out by hand, taking care not to damage it. Remove loose soil, gently cleanse off most of remaining soil, or rinse off the storage organ. Group these according to species and label clearly, keep records of labels to include name if that is known, or a brief description or photo, also the average depth of the organs when they were removed, and the habitat they were removed from. Spread these plants so that the storage organ can dry completely, and then loosely pack into newspaper or paper bag and then store in a shaded, dry position for maximally 3 months. Transplant into soil that is as similar as possible to the original habitat, TAKING CARE that the growing point of the organ points to the top, else the plant will die. Make sure the storage organs are positioned according to the records kept about original depth of the storage organ.

Aftercare: Firm down soil around the base of the plant once it is in a new position. Allow plant to resprout naturally after sufficient rains, do not water. As these plants may not be visible for a while, clearly demarcate the area where these have been planted to avoid disturbing and potentially destroying them later on.

# APPENDIX I(D):

# DRAFT BIRD MONITORING PROGRAMME FOR THE OPERATIONAL PHASE

# DRAFT BIRD MONITORING PROGRAMME FOR THE OPERATIONAL PHASE

## 1. Purpose

This document serves as a framework for the set-up of post-construction bird monitoring set-up during the operational phase of the wind energy facility. Aims include:

» To compare the abundance index for all the priority species within the development area after construction against the pre-construction baseline to measure actual displacement due to the construction and operation of the wind farm. Recommended survey method is line transect counts.
» To estimate the risk of priority species colliding with the wind turbines by recording actual collisions and comparing post-construction flight patterns with pre-construction baseline data. Recommended methods are carcass searches and VP watches.

This document was originally submitted as part of the final EIR submission in 2014. The monitoring will need to be updated based on current guidelines.

## 2. Methodology for calculating abundance index using line transects

Ideally, surveys should be conducted in two seasons of years 1, 2, 3, 5, 10 and 15; after the wind farm becomes operational. Bird responses to wind farms may operate over very long periods of time, and that monitoring needs to take this into account, as results from short term observational studies are unlikely to be representative.

## 3. Methodology for estimating actual collision rates using carcass searches

Carcass searches are the most direct way of estimating the number of collisions and hence the likely impact on species of conservation importance. Measures of the number of collisions can also help to quantify avoidance rates (as used in collision risk modelling calculations), and, when collisions can be ascribed to a particular time, contribute to an understanding of environmental conditions and behaviours that increase collision risk.

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed. To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, sometime before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 20. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcasses are

scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximise survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate. Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates should be measured twice during the monitoring year, once in winter and once in summer.

The area within a radius of at least 50 m of each of the turbines (from the outer edge of rotor zone) at the facility should be checked regularly for bird casualties. The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period (see above), but they should be done at least weekly for the first two months of the study. The area around each turbine, or a larger area encompassing the entire facility, should be divided into quadrants, and each should be carefully and methodically searched for any sign of a bird collision incident (carcasses, dismembered body parts, scattered feathers, injured birds). All suspected collision incidents should be comprehensively documented, detailing the precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labelled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box. The local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre. In such cases, the immediate area of the recovery should be searched for evidence of impact with the turbine blades, and any such evidence should be fully documented (as above).

This document can be updated as and when required.

## 4. References

Barnes, K.N. 2000. The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Randburg, 2000.

De Lucas, M., Janss G.F.E and Ferrer M. A bird and small mammal BACI and IG design studies in a wind farm in Malpica (Spain). 2005. Biodiversity and Conservation 14:3289-3303

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. *The atlas of southern African birds*. Vol. 1&2. BirdLife South Africa: Johannesburg.

Jenkins, A.R., Van Rooyen, C., Smallie, J., Anderson, M.D., & Smit, H. 2011. BirdLife South Africa/Endangered Wildlife Trust Best Practice Guidelines for Avian Monitoring and Impact Mitigation at proposed wind energy development sites in southern Africa.

Retief, E.F, Diamond, M., Anderson, M.D., Smit, Dr. H.A., Jenkins Dr. A. & Brooks, M. 2011. *Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures Used.*

StatSoft, Inc. STATISTICA (data analysis software system), Version 10. 2011
www.Statsoft.com.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. *Coordinated waterbird Counts in South Africa, 1992-1997*. Avian Demography Unit, Cape Town.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.D. and Colahan, B.D. (eds). 2003. Big Birds on Farms: Mazda CAR Report 1993-2001. Avian Demographic Unit. University of Cape Town, South Africa.

# APPENDIX I(E):

# DRAFT BAT MONITORING PROGRAMME FOR THE OPERATIONAL PHASE

# DRAFT BAT MONITORING PROGRAMME FOR THE OPERATIONAL PHASE

## 1. Purpose

At present there is no credible knowledge concerning how South African bats are affected by the installation and operation of wind energy turbines. Therefore a post-construction bat monitoring study is advised. The purpose of this document is provide the principles for bat monitoring during the operational phase of the wind energy facility

This document was originally submitted as part of the final EIR submission in 2014. The monitoring will need to be updated based on current guidelines.

## 2. Aim of Monitoring

The aim of post-construction bat monitoring would be to analyse changes in bat activity patterns, perform mortality surveys and counts at specific turbines where fatalities are noticed to be the highest and to assess the effectiveness of the suggested mitigations.

If the negative impact of the turbines is significant enough to have impacted the ability of the bat population to survive, reproduce, or be affected significantly in their local distribution or abundance, this puts the population of bats at risk. This in turn runs the risk of infringing the National Environmental Management: Biodiversity Act 10 of 2004, unless mitigation is implemented.

The first two years of wind farm operation is the vital period in which to collect post-construction data as this is when any change in bat activity and mortalities are most likely to occur.

The South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments (Sowler & Stoffberg, 2014) recommend that a minimum of two years intensive post-construction monitoring be undertaken, but auditing for impacts should continue throughout the lifespan of the facility (Sowler & Stoffberg, 2014). The post-construction study should ideally additionally utilise acoustic monitoring via passive bat detectors installed at the nacelle (hub/casing) height on turbines identified most likely to be at risk from having bat activity and potentially causing mortality.

Operational phase bat monitoring objectives include

- Determine mortality rates following construction and operation of wind farm
- Assess changes in bat activity patterns due to turbines
- Quantify the impacts of the operational wind energy facility with the use of pre-construction monitoring data
- Identify bat species subject to mortality
- Identify causes of mortality
- Identify specific periods of high mortality rates
- Evaluate the success of mitigation measures, and inform an adaptive mitigation plan and application

## 3. Monitoring Protocol

The bat monitoring should be carried out throughout all seasons of the year, especially during periods with increased rainfall and temperatures when insect numbers may be elevated. Sampling effort for carcass searches should be every 7 days preferably and can be done by local independent staff. Acoustic data collection from the passive systems would typically be every 3 months by specialists visiting the site. During each site visit stored carcass' should be identified, carcass searches conducted and infrared/thermal technology may be utilised to observe bat activity and behaviour around turbines and on site.

A statistically relevant sub-sample of the turbines should be selected for monitoring to cover all impacted habitat types and spatial extent of the developed area, as well as allowing for experimental comparisons during application of adaptive mitigation management.

» Acoustic monitoring

Acoustic monitoring equipment (e.g. SM3BAT ultrasonic recorder) should be installed at the nacelle height on selected turbines, these systems will record bat activity continuously every night for the entire night, for comparison to mortalities in order to estimate a proportionate mortality rate of local bat populations.

» Mortality surveys

Mortality surveys should be carried out to identify the number of bats killed per turbine over a known period of time (expressed as bats/turbine/time). This value represents a minimum estimate of bat mortality and is adjusted for bat carcass removal rates and searcher efficiency.

Mortality surveys typically include the following procedures:

» Standardized Search: counting the number of carcasses found around the turbines identified to potentially cause mortality
» Carcass Removal Trials: monitoring of bat carcasses removed by scavengers to estimate the length of time that carcasses remain in the field
» Searcher Efficiency Trials: percentage of carcasses found by searchers in the varying habitats throughout the wind farm.
» Quantify and if possible standardise the searchable plot area around each turbine, also ideally rate searchable areas according to a likely risk of not finding a carcass.

Transect size and spacing of mortality surveys

Surveys should be concentrated under the turbine and cover an area of at least 1/2 of the turbine height where possible and feasible. Searches should ideally be symmetrical around the turbine using linear/circular transects equally spaced if possible.

When found, carcasses should be photographed in the position found, GPS position noted, and collected. Carcasses should be collected in plastic bags, labelled, and frozen for species identification and/or

autopsy. This proposal relies on the assumption that local staff will be available on a weekly basis for carcass searches.

## 4. Adaptive management approach

The effects of turbines and wind farms on South African bats are unknown. Currently there are no South African guidelines for a post – construction bat monitoring protocol that is adaptive for our unique challenges. Thus the methodology described in this document is tentative and subject to change. The monitoring program may also be adapted to suit field conditions.

A precautionary and adaptive mitigation management approach must be adopted based on the results and certainty of results of the post – construction bat monitoring program. Mitigation management and mortality surveys may possibly be altered significantly as technological advancements can cause other methodologies to be more favourable.

This document may be updated as and when required.

Reviewed and signed off by:

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## 5. References

ACR. 2010. *African Chiroptera Report, 2010*. African Bats, Pretoria.

Bernard, R. T. F. and Tsita, J. N. 1995.Seasonally monoestrous reproduction in the molossid bat, *Tadarida aegyptiaca,* from low temperature latitudes (35$^0$S) in South Africa. *South African Journal of Zoology* 30: 18-22.

Cryan, P.M. and R.M.R. Barclay. 2009. Causes of bat fatalities at wind turbines: Hypotheses and predictions. *Journal of Mammalogy* 90: 1330-1340.

Herselman, J. C. 1980. The distribution and status of bats in the Cape Province. International Report. Cape Department of Nature and Environmental Conservation.

Lynch, C. D. 1989. The mammals of the north-eastern Cape Province. *Mem. Nas. Mus. Bloemfontein* 25: 1-116.

Monadjem, A., Taylor, P.J., Cotterill, F.P.D. & Schoeman, M.C. (2010). *Bats of southern and central Africa – A biogeographic and taxonomic synthesis*, Ultra Litho (Pty) Ltd, Johannesburg.

Mucina, L. and Rutherford, M. C. 2006. The Vegetation of South Africa, Lesotho and Swaziland-*Strelitzia 19,* South African National Biodiversity Institute, Pretoria.

Sowler, S. and Stoffberg, S. 2014. South African good practice guidelines for surveying bats in wind farm developments. *Endangered Wildlife Trust.*

Taylor, P. J. 2000. Bats of southern Africa, University of Natal Press, Pietermaritzburg.

van der Merwe, M. 1979. Growth of ovarian follicles in the Natal clinging bat. South African Journal of Zoology 14: 111-117.

van der Merwe, M. 1994. Reproductive biology of the Cape serotine bat, Eptesicus capensis, in the Transvaal, South Africa. South African Journal of Zoology 29: 36-39.