

**Environmental Impact Assessment for the  
proposed Ubuntu Wind Energy Project near  
Jeffrey's Bay, Eastern Cape:  
Final Environmental Impact Assessment Report**

**SECTION B:  
Environmental  
Management Plan**



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## 1 PROJECT OVERVIEW

This Environmental Management Plan (EMP) is prepared as part of the requirements of the EIA Regulations promulgated under the National Environmental Management Act (Act 107 of 1998). The EMP is to be submitted to the national Department of Environmental Affairs (DEA) as part of the application for environmental authorisation for the proposed Ubuntu wind energy project commissioned by WKN-Windcurrent project near Jeffrey's Bay (DEA EIA reference no. 12/12/20/1752).

This EMP is intended as a "living" document and should continue to be updated regularly by WKN-Windcurrent.

A detailed description of the proposed Ubuntu project is contained in Chapter 2 of the EIA Report; and a description of the affected environment is provided in Chapter 3 of the EIA Report.

## 2 APPROACH TO PREPARING THE EMP

The Environmental Management Plan is divided into four phases of the project cycle:

- Detailed design phase, including wind monitoring micro-siting of turbines (section 4);
- Construction phase (section 5);
- Operations phase (section 6); and
- Decommissioning phase (section 7).

The EMP is based largely on the findings and recommendations of the EIA process. However, the EMP is considered a "live" document and must be updated with additional information or actions during the design, construction and operations phases.

The EMP follows an approach of identifying an over-arching goal and objectives, accompanied by management actions that are aimed at achieving these objectives. The management actions are presented in a table format in order to show the links between the goal and associated objectives, actions, responsibilities, monitoring requirements and targets. The management plans for the design, construction, operation and decommissioning phases consist of the following components:

- **Goal:** Over-arching environmental goal proposed for the Ubuntu project near Jeffrey's Bay.
- **Objectives:** The objectives necessary in order to meet the goal; these take into account the findings of the environmental impact assessment specialist studies.
- **Management actions:** The actions needed to achieve the objectives, taking into consideration factors such as responsibility, methods, frequency, resources required and prioritisation.
- **Monitoring:** The key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting.

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**Criteria/targets:** The criteria or targets that indicate the efficacy of the management plan. The targets should be readily measurable, understandable to the layperson, cost-effective to monitor, and meet legal requirements.

**Remedial actions:** Where necessary, actions to be undertaken if the targets are not being met; or if there is a catastrophic event.

**Goal for environmental management:**

The overall goal for environmental management for the Ubuntu project is to construct and operate the project in a manner that:

- Minimises the ecological footprint of the project on the local environment;
- Minimises impacts on birds, bats and other fauna on site;
- Facilitates harmonious co-existence between the project and other land uses in the area;
- Contributes to the environmental baseline and understanding of environmental impacts of wind farms in a South African context through providing monitoring records from the construction and operation phases, especially with regard to potential impacts on birds and bats.

## **3 ROLES AND RESPONSIBILITIES**

For the purposes of the EMP, the generic roles that need to be defined are those of the:

- Project Developer;
- Environmental Control Officer (ECO);
- Construction Manager; and
- Operations Manager.

*Note:* The specific titles for these functions will vary from project to project. The intent of this section is to give a generic outline of what these roles typically require.

### **3.1 PROJECT DEVELOPER**

The Project Developer (i.e. WKN-Windcurrent) is the 'owner' of the project and as such is responsible for ensuring that the conditions of the Environmental Authorisation issued by DEA in terms of NEMA (should the project receive such authorisation) are fully satisfied, as well as ensuring that any other necessary permits or licences are obtained and complied with. It is expected that the Project Developer will appoint the Construction Manager and the Operations Manager.

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### 3.2 ENVIRONMENTAL CONTROL OFFICER

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

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

- Meeting on site with the Construction Manager prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Weekly or bi-weekly (i.e. every two weeks) monitoring of site activities during construction to ensure adherence to the specifications contained in the EMP, using a monitoring checklist that is to be prepared by the ECO at the start of the construction phase;
- Preparation of the monitoring report based on the weekly or bi-weekly site visit; and
- Conducting an environmental inspection on completion of the construction period and 'signing off' the construction process with the Construction Manager.

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

Overseeing the implementation of the EMP for the operation phase;  
Ensure that the necessary environmental monitoring takes place as specified in the EMP; and  
Update the EMP and ensure that records are kept of all monitoring activities and results.

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

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

At the time of preparing this draft EMP, the ECO appointment is still to be made by the proponent. The appointment is dependent upon the project proceeding to the construction phase.

### 3.3 LEAD CONTRACTOR

The lead contractor will be responsible for the following:

- Overall construction programme, project delivery and quality control for the construction for the wind project;
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction;
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment;

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- Ensuring that safe, environmentally acceptable working methods and practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely;
- Meeting on site with the Environmental Control Officer prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Ensuring that all appointed contractors and sub-contractors are aware of this Environmental Management Plan and their responsibilities in relation to the plan; and
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the Environmental Management Plan, to the satisfaction of the Environmental Control Officer.

At the time of preparing this draft EMP, the appointment of a lead contractor has not been made and will depend on the project proceeding to the construction phase.

### **3.4 OPERATIONS MANAGER**

The Operations Manager will be responsible for the following:

- Operation of the wind energy facility;
- Required maintenance of the turbines; and
- Ensuring that the specified environmental monitoring programmes during operations are undertaken effectively and that the findings are analysed and applied.

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## 4 MANAGEMENT PLAN FOR DESIGN PHASE

Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
1. Turbine selection, design and layout to minimise impact on the visual character of the area.	Non uniform turbines, larger clusters of turbines, and haphazard layout in the landscape give rise to a strong visual impact and negative public response.	a) Turbines should have uniform design, speed, colour, height and rotor diameter.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Ensure that turbine design and layout is uniform.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Uniform and harmonious layout for the wind farm.	None identified.
2. Minimise noise emissions through selection of appropriate modern turbine technology.	Use of older technology turbines could generate higher noise levels.	a) Use modern wind turbines to ensure minimum noise emissions.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Confirm that noise emissions for actual selected turbines are comparable to or better than examples of turbines used in noise study for the EIA.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Predicted noise from the turbines at the identified Noise Sensitive Areas to be less than the 45 dBA presented in SANS 10103:2008 for rural areas.	None identified.
4. Design of turbines and power lines to minimise risk of collisions for birds.	Turbine rotors inconspicuous to birds.  Birds encouraged to perch on turbine towers.  Above grounds power lines cross bird flight paths.	a) Turbine blades and towers to be white to maximize conspicuousness to flying birds. b) Plan power lines between turbines to be underground (except possibly where lines cross water courses) and minimise above-ground connection to sub-station. c) The results of the pre-construction bird monitoring should determine the need and scope for post construction monitoring.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Review final design to confirm that turbine design colour is white.  Review the findings of the pre-construction bird survey.  <i><u>Responsibility: Project Developer, WKN-Windcurrent</u></i>	Design of turbines to minimise impacts on birds.	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
5. Manage turbines to minimise the risk of collision or barotrauma for bats.	Turbines inconspicuous to bats	<p>a) Continue with the pre-construction bat monitoring programme as agreed to with the bat specialist to better understand bat occurrences in the study area, and thereby to inform the management actions to minimise impacts on bats.</p> <p><u>Responsibility: Project Developer, WKN-Windcurrent</u></p>	<p>Conduct pre-construction bat monitoring to develop a baseline that can be used to inform management actions during the operations phase.</p> <p><u>Responsibility: Project Developer, WKN-Windcurrent</u></p>	WKN-Windcurrent report on pre-construction bat monitoring at their sites over one year (four seasons) assists in developing a baseline for bats in the local area.	None identified.
6. Manage stormwater on site	Stormwater damage on site	<p>a) All roads and cranepads will be constructed in a manner that water will be able to run into the unsealed ground. Water running onto the sealed area of the foundations of approx. 250 m<sup>2</sup> each will drain into the ground next to the foundations. Drainage systems which are in place before construction of the wind farm will not be changed and will be reinstated should construction work damage these.</p>	<p>Monitor stormwater drainage and report any potential problems to inform management actions during the operations phase.</p> <p><u>Responsibility: Project Developer, WKN-</u></p>	Stormwater management measures in place leading to effective stormwater management on site.	None identified



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## 5 MANAGEMENT PLAN FOR CONSTRUCTION PHASE

Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
<b>5.1 Minimising the project impact on flora and fauna (in particular designated areas for protecting ecosystem processes)</b>					
1. Minimise loss of vegetation cover from construction of the turbines and access roads to the turbine sites	Turbine positions and design of roads are not informed by the "no-go" areas identified in the sensitivity map and leads to unnecessary clearing of natural habitat.	<p>a) Micro-siting of footprints should avoid more sensitive vegetation as far as possible.</p> <p>b) Access roads to the turbines must avoid any ephemeral pans, if present. This is unlikely to be an issue, but must be considered in access road planning. The impact of access roads will be greater where they traverse habitats on exposed outcrops and small thicket clumps (microhabitats).</p> <p>c) River crossing and clearing of thicket should be avoided</p> <p>d) Crossing of riparian areas should use existing road crossings where possible</p> <p><i><u>Responsibility: Construction Manager</u></i></p>	<p>Ensure layout (design) of turbines and construction of the roads minimises the impact on natural habitat.</p> <p>Ensure that plant species of special concern (SSCs) are removed before clearing.</p> <p>Ensure river crossing and clearing of thicket are avoided.</p> <p>Ensure that crossing of riparian areas uses existing road crossings.</p> <p><i><u>Responsibility: ECO</u></i></p>	<p>Turbine positions and road layout is strictly in accordance with the current layouts prepared by WKN-Windcurrent which take due cognisance of the environmental constraints identified by the specialists.</p> <p>Removal and relocation of all SSC(species of special concern)</p>	None identified.
2. Minimise direct loss of habitat from turbine footprints	<p>Construction impacts are not properly managed.</p> <p>"No go" areas for construction are not enforced</p>	<p>a) The construction site must be clearly demarcated prior to the commencement of construction.</p> <p>b) Contractors and construction workers must be clearly informed of the no-go areas on site (i.e. outside demarcated areas) and</p>	<p>Final siting of footprints should be undertaken by the WKN-Windcurrent ECO in consultation with respective specialists to minimise any unnecessary loss.</p>	<p>In the final layout, sensitive micro-siting of the turbine footprints lead to negligible impact on the designated conservation networks</p>	None identified.

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		<p>held accountable for any infringements that may occur.</p> <p>d) A suitable control measure (such as a fine system) must be implemented to discourage infringement by contractors on the no-go areas.</p> <p>e) Activities including but not restricted to the following must not be permitted in designated no go areas: Dumping of any material during and after construction; Turning of vehicles; or Trampling.</p> <p>f) Any additional project footprint (e.g. for construction and lay-down areas) should be sited in areas approved in consultation with the ECO and preferably in areas where habitat is already transformed.</p> <p><i><u>Responsibility: Construction Manager</u></i></p>		and areas.	
3. Protection of plant and animal species of special concern	Loss of species of special concern (SCC) through poor on-site management during construction.	<p>a) Species of Special Concern (SCC) and protected plant species (identified in Table 5.4 in the EIA Report) must be removed from the sites prior to development taking place, so far as possible. A suitable timeframe must be allowed before construction commences to undertake the plant rescue and relocation.</p> <p>b) Relocation of SCC, where unavoidable, must be into adjacent areas or a suitable nursery. Plants that are not necessarily SCC but which can be used during rehabilitation should be identified and stored appropriately</p>	If SSC have to be moved or relocated, the relevant permits must have been obtained from DEDEA, as per requirements of the Provincial Nature Conservation Ordinance of 1974.	Zero or close to zero loss of readily identifiable species of special concern on the project site species.	None identified.

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		on-site for use after construction. <i>Responsibility: ECO</i>			
4. Remove and store all topsoil from areas to be excavated; and use this topsoil in later rehabilitation of disturbed areas, e.g. the lay-down area, construction yard, trenches for electrical cables, foundation areas, and the access roads.	Excessive and unnecessary clearing on natural habitat.  Top soil is mixed with other material (e.g. rock and rubble) and cannot be replaced as part of the rehabilitation programme.	a) Demarcate the areas to be cleared at each turbine location and do not allow vehicles and construction activities to extend outside of these demarcated areas.  b) Excavated topsoil (top 20 cm, if this exists) to be stockpiled in the demarcated areas.  c) Excavated/disturbed areas on site and adjacent to the site (apart from on-site Borrow pits, which are subject of a separate application and approval) have topsoil replaced to a depth of at least 10 cm during the rehabilitation phase of the construction period (provided such soil is available from on-site stockpiles). This applies to the underground electrical cable route, road verges, area around turbine concrete foundation (to enable grazing to the edge of the foundation), parts of lay-down area where topsoil was disturbed, and the rehabilitation along on the edges of the access roads.  <i>Responsibility (a) and (b): Construction Manager and contractors and sub-contractors</i>	Ensure that topsoil is stored as specified until replaced.  Ensure that excavated / disturbed areas have topsoil replaced to a depth of at least 10 cm, (provided material is available).  <i>Responsibility: ECO</i>	All topsoil is stored and replaced without loss.  All topsoil is replaced in excavated / disturbed areas as part of the rehabilitation programme.	None identified.
5. Minimise the risk of invasion by alien plant species into the disturbed	Alien plant species may pose a threat to the re-establishment of	a) A long term alien management plan to eradicate and control invasive plant species must be implemented by WKN-	An alien plant management programme has been developed, funded and implemented affectively	Removal of all alien species within the construction area	None identified.

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areas	indigenous species.	<p>Windcurrent within their lease areas.</p> <p>b) Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist).</p> <p>c) Cleared vegetation must be either removed from site or burned in-situ in the temporary storage area.</p> <p>d) Any seed bearing material should be removed from the drainage area to prevent the spread of seed.</p> <p>e) Chopped brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities.</p> <p>f) Kikuyu grass must NOT be utilised during redressing of verges, turbine footprints and other landscaped areas within the site.</p> <p><i><u>Responsibility: Construction Manager</u></i></p>	<p>within the WKN-Windcurrent lease area.</p> <p>A suitable re-vegetation or rehabilitation plan must be implemented after alien vegetation clearing.</p> <p><i><u>Responsibility: ECO</u></i></p>		
6. Ensure that all disturbed areas are rehabilitated using indigenous species	<p>Disturbed areas are not rehabilitated.</p> <p>Use of alien species for rehabilitation (e.g. grasses).</p>	<p>a) Disturbed areas will be rehabilitated with the placement of in situ material (top soil, where available) and the planting with indigenous species.</p> <p><i><u>Responsibility: Construction Manager</u></i></p>	<p>Visual check to ensure that rehabilitation has been undertaken for all accessible disturbed areas.</p> <p><i><u>Responsibility: ECO</u></i></p>	Disturbed areas are rehabilitated immediately after the construction phase & adequately maintained.	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
7. Minimise the impact of construction on fauna on the turbine sites	Construction impacts are not properly managed.	<p>a) Remove tortoises, mammals and amphibians from the turbine sites and new access roads before the start of site clearing construction and relocating these to a place similar to the place where it was found.</p> <p><i>Responsibility: ECO</i></p> <p>b) A speed limit of 60 km/h needs to be implemented on the access roads to the site and a 40 km/h speed limit on the construction sites and for the cranes.</p> <p>c) Professional reptile remover (with the necessary permits) should be contacted to remove dangerous reptiles (e.g. poisonous snakes) when in conflict with the workers.</p> <p><i>Responsibility: Construction Manager</i></p>	<p>Rescue operations have been conducted based on recommendations from ECO and Construction Manager.</p> <p>Monitor for injured fauna and DoR incidents</p> <p><i>Responsibility: ECO</i></p>	Successful rescue operations being performed.	
8. Ensure that the storage and operation of construction equipment and activities of personnel are contained within the designated work areas	Dumping or damage of the environment by construction equipment outside of demarcated construction areas.	<p>a) Before construction commences, a site map is to be prepared by the WKN-Windcurrent ECO in consultation with the Contractor, showing designated work areas, locations of temporary toilets, no-go areas, eating &amp; cooking areas, smoking areas, concrete mixing areas (if any), fuel storage areas, vehicle routes and laydown areas.</p> <p>b) Before construction commences, mark the designated work areas on each site using poles and hazard tape or snow netting.</p> <p>c) If possible, establish laydown areas in areas that are already degraded.</p> <p><i>Responsibility (a), (b) and (c): ECO,</i></p>	<p>Construction Manager to ensure that all contractors and sub-contractors and other operators on site are briefed at the start of their contract on environmental controls and no-go areas.</p> <p>ECO to monitor compliance with the EMP during the construction phase, on weekly or bi-weekly basis, using a report card.</p>	Zero disturbance outside of designated work areas.	The ECO is to be notified within 24 hours if a disturbance incident occurs; penalties to be levied on defaulting contractors and sub-contractors.

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		<p><u>in consultation with Construction Manager</u></p> <p>d) Educate workers on the need to stay on paths and established tracks wherever practical.</p> <p>e) Construction equipment is not be operated outside the designated work area</p> <p>f) Activities of personnel are restricted to the designated work areas, unless under supervision by the ECO</p> <p>g) A penalty system is included in contractors and sub-contractors agreements, clearly documenting the penalties applicable for disturbance outside of demarcated areas.</p> <p><u>Responsibility (d) to (h): ECO to identify transgressions; Construction Manager to levy penalties</u></p>			
9. Avoid soil erosion within and in the vicinity of the construction area.	Disturbed areas are left un-rehabilitated for a long period, leading to erosion, especially if on steep slopes.	<p>a) Uncontaminated waste water and excess run off must not be concentrated but allowed to dissipate and seep slowly into the soil in a manner which inhibits soil erosion.</p> <p><u>Responsibility: Construction Manager</u></p>	<p>Weekly or bi-weekly visual inspection</p> <p><u>Responsibility: ECO</u></p>	Minimal erosion inside the construction area and surroundings.	ECO to inform the Construction Manager if erosion occurs and investigate options to mitigate the damage.
10. Effective rehabilitation of the turbine sites and new access roads after construction	Erosion and occur and alien vegetation can spread rapidly if areas have been poorly rehabilitated.	<p>a) Implement an effective rehabilitation programme in accordance with the guidelines provided by the botanical specialist in Appendix B.1 of the EMP.</p> <p><u>Responsibility: ECO or Construction Manager</u></p>	Audit of rehabilitation by the appointed botanist after construction.	Long-term successful rehabilitation.	Additional rehabilitation would be required.

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11. Minimise risks to changes in natural fire regime	Fynbos vegetation on site at risk as elimination of all fires is negative for fynbos-	a) Fire management plan to be implemented	Record any fires	Zero risk to fynbos on site,	None
<b>5.2 Avoiding any project impact on heritage (palaeontological, archaeological and historical features)</b>					
1. Identify and protect <u>archaeological</u> features that may occur on the turbine sites.	Irreversible damage to archaeological features on the turbine sites.	a) An archaeologist/SAHRA must be informed if any features/sites are found accidentally. b) ECO to provide training for contractors and sub-contractors on site to assist them in identifying potential features of archaeological value.  <u>Responsibility: ECO</u>	Contact the identified archaeologist if any heritage features (or suspected features) are uncovered.  <u>Responsibility: ECO</u>	No damage to any significant archaeological features on site.  Examination, documentation and/or removal of artefacts by archaeologist.	If archaeological features are uncovered unexpectedly during construction, stop construction and consult an archaeologist or SAHRA.
2. Identify and protect <u>palaeontological</u> features that may occur on the turbine sites.	Damage to or destruction of palaeontological features (e.g. fossils) that may occur on the turbine sites.	a) If construction involves substantial bedrock excavations WKN-Windcurrent ECO should be alerted to the possibility of buried fossil heritage and all major bedrock excavations should be examined at intervals for fossil material by the WKN-Windcurrent ECO.  b) If any substantial fossil remains are found or exposed, these should be safeguarded, preferably in situ, while SAHRA is contacted by the WKN-Windcurrent ECO and a qualified palaeontologist is contracted to record and sample the occurrence. Mitigation in the form of fossil recording and collection will have a <u>positive</u> impact on our appreciation of local fossil heritage.  c) ECO to be present on site during major	Contact the identified palaeontologist and archaeologist if any heritage features (or suspected features) are uncovered.  <u>Responsibility: ECO</u>	No damage to any significant palaeontological or archaeological features on site.  Examination, documentation and/or removal of artefacts by archaeologist or palaeontologist.	ECO to inform the palaeontologist or archaeologist if any damages occur to features on site, and investigate options for mitigating damage.

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		<p>excavation and trenching.</p> <p>d) ECO to provide training for contractors and sub-contractors on site to assist them in identifying potential features of palaeontological value.</p> <p><i>Responsibility: ECO</i></p>			
<b>5.3 Prevention of soil and groundwater contamination</b>					
1. Prevent the spillage of fuel, oil or grease on site and remedy this should it occur	Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils	<p>a) Construction equipment is checked daily (by Contractor) to ensure that no fuel spillage takes place from construction vehicles or machinery, and monitored weekly by the WKN-Windcurrent ECO.</p> <p>b) Spilled fuel, oil or grease is retrieved where possible, and contaminated soil removed, cleaned and replaced. Contaminated soil to be collected by the Contractor (under observation of ECO) and disposed of at a waste site designated for this purpose.</p> <p>c) Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.</p> <p>d) Bunded containment to be provided below and around any fuel storage containers.</p> <p><i>Responsibility (a), (b) &amp; (c): Civil contractors and sub-contractors</i></p>	<p>Check daily that no spills have taken place</p> <p><i>Responsibility: Construction Manager</i></p>	Zero spillage of fuel, oil or grease on site	Rapid removal, cleaning and replacement of any soil contaminated by fuel, oil or grease.
2. Prevent spillage of cement, sand and stone into soil and vegetation beyond the defined area for concrete	Contamination of soil (change in pH) and risk of damage to vegetation and/or fauna through spillage of	<p>a) Concrete mixing area (if any) is defined in the site map. If any concrete mixing takes place on site, this is to be done on board or plastic sheeting, which is to be removed</p>	Check daily that sand, stone and cement are stored and handled as instructed	Minimum spillage of cement into the environment; zero	None identified.



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mixing and batching	concrete	<p>from the site once concreting is completed; or in areas to be covered by further construction.</p> <p>b) Sand, stone and cement are stored in demarcated areas, and are covered or sealed to prevent wind erosion and resultant deposition of dust on the surrounding indigenous vegetation.</p> <p>c) Any excess sand, stone and cement must be removed from site at the completion of the construction period</p> <p><i>Responsibility (a) to (c): Civil contractors and sub-contractors.</i></p>	<p><u>Responsibility:</u> <u>ECO</u></p>	spillage beyond the site	
<b>5.4 Effective management of civil contractors and sub-contractors</b>					
1. Ensure disciplined operation of sub-contractors	Contractors and sub-contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment.	<p>a) The terms of this EMP and the potential conditions in the environmental authorisation (from DEA) will be included in all tender documentation and contractors and sub-contractors contracts.</p> <p>b) Contractors and sub-contractors will not be permitted to remain on the site overnight.</p> <p>c) Contractors and sub-contractors will use the chemical toilet situated in a designated area of the site; no personal hygiene (e.g. washing) will be permitted outside the designated area.</p> <p>d) Cooking will take place in a designated area shown on the site map and no firewood or kindling may be gathered from the site or surrounds.</p> <p>e) All litter will be deposited in a clearly</p>	<p>Check compliance with specified conditions on a weekly or bi-weekly basis, using a report card, and allocate fines when necessary.</p> <p><u>Responsibility:</u> <u>ECO</u></p>	Complete compliance with specified conditions	Significant fines to be imposed by ECO for infringements.

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		<p>marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.</p> <p>f) No one other than the ECO or personnel authorised by the ECO, will disturb or pick plants outside the demarcated construction area</p> <p>g) No one other than the ECO or personnel authorised by the ECO, will disturb animals on the site (no trapping, shooting etc.)</p> <p>h) Animals disturbed during construction activities should not be harmed but should be allowed to move off to an undisturbed area of the site</p> <p>i) Feral dogs and cats should not be fed or encouraged to visit the site</p> <p><i><u>Responsibility: Construction Manager</u></i></p> <p>j) Fines system to be established clearly documenting the penalties to be applied for contravening the above requirements. This fines system must be established before construction commenced and included in sub-contracts.</p> <p><i><u>Responsibility: ECO</u></i></p>			

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<b>5.5 Minimisation of Visual impacts</b>					
1. Minimise contrast with surrounding environment and visibility of the turbines to humans	A non-specified turbine colour (i.e. a bright colour) could result in increased visual impact on local residents and passers by.	a) Ensure that the turbines are painted a non-reflective white colour (as required in the Civil Aviation legislation) b) Dust suppression is important during construction as dust will increase the visibility of the project c) Good housekeeping measures must be implementing-e.g. no dumping of waste  <u>Responsibility: WKN-Windcurrent, Construction Manager and ECO</u>	Ensure that the specified paint colour is included in the purchasing specifications and complied with during construction.  <u>Responsibility: WKN-Windcurrent</u>	Any departure from the specified colour should be corrected before operation commences.	None required.
<b>5.6 Satisfy human safety and aviation requirements</b>					
1. Ensure adequate earthing and lightning protection for the turbines	Risk to the turbines and surrounding environment from lightning and/or inadequate earthing.	a) Ensure proper bonding is carried out inside the turbines; a copper ring is attached below the soil surface to earth down conductors and earthing rods.  <u>Responsibility: Construction Manager</u>	Ensure that earthing and lightning protection are installed and functional before construction is completed.  <u>Responsibility: Construction Manager</u>	Earthing and lightning protection fully functional.	None required
2. Ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft, i.e. red pulsating light on the turbine tower	Risk to aircraft.	a) Mount aviation warning lights on turbine hub and/or such measures required by the Civil Aviation Authority.  <u>Responsibility: WKN-Windcurrent</u>	Ensure that aviation warning lights or other measures are functional before construction is completed.  <u>Responsibility: WKN-Windcurrent</u>	Aviation warning lights or other measures are functional at all times.	None required
3. Colour of turbines to be	Turbine rotors	a) Turbine blades to be white to be	Verify that the turbine blades	Turbine design	None identified.

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conspicuous to minimize aircraft collision risks and comply with the Civil Aviation Regulations of 1997.1	inconspicuous to aircraft.	conspicuous to aircraft pilots.  <i>Responsibility: Operations Manager, WKN-Windcurrent</i>	are white.  <i>Responsibility: ECO</i>	maximizes conspicuousness to aircrafts.	
<b>5.7 Minimise impacts on birds and bats</b>					
1. Minimize the risk of birds and bats colliding with turbines and/or powerlines.	Birds attracted by perching opportunities, towers and turbines, leading to entanglement and bird deaths.  Priority bird species are killed by electrocution or entanglement with powerlines.	a) Power line connections between the turbines to be underground, except where crossing streams (where erosion could occur).  b) For above ground power lines, consult with a bird specialist to determine the need for fitting bird anti-collision markers to these power lines.  <i>Responsibility: Construction Manager</i>	Minimise the extent of above-ground power lines.  Ensure that anti-collision markers are fit to the power line prior commissioning of the wind farm.  <i>Responsibility: ECO</i>	No collisions by birds during construction phase	If bird carcasses found, these must be collected and sent for analysis by an appropriate institution.
2. Minimize the risk of displacement of priority bird species by disturbance	Priority bird species displaced by disturbance	a) Restrict the construction activities to the footprint area. Do not allow any access to the remainder of the property.  <i>Responsibility: Construction Manager and ECO</i>	Ensure that construction activities are restricted to footprint area.  <i>Responsibility: ECO</i>	Priority bird species are not displaced due to disturbance.	None identified.

<sup>1</sup> According to the Aviation Act, 1962, Thirteenth Amendment of the Civil Aviation Regulations (CAR's), 1997: "Wind turbines shall be painted bright white to provide maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required." Camouflage, even if it were effective as a mitigatory measure (see Gipe 1995 and Stanton 1996), can therefore not be used.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
3. Minimize the loss of roosts for bat species using trees, aloes and man-made structures	Clearing of trees and aloes result in the loss of roosts for bat species.  New bat habitat created on site.	a) Avoid the removal of clumps of indigenous trees and aloes.  b) Seal all existing buildings which have not got bat roosts within the study area.  c) Seal off all new building structures within the study area.  <i>Responsibility: Construction Manager and ECO</i>	Ensure that construction activities are restricted to footprint area.  Responsibility: ECO	Roosts for bat species are not lost.	None identified.
4. Prevent displacement or exclusion of bats from foraging areas and the loss or shifting of flight paths	Turbines erected too close to areas where bats may roost	a) Maintain setback of 500 m from areas where bats may roost, such as human dwellings or sheds, and a setback of 200 m around water bodies where bats might drink.  <i>Responsibility: Construction Manager and ECO</i>	Ensure that 500 m setback is implemented from areas where bats may roost and a setback of 200 m around water bodies.	Setback of 500 m from bat roost areas and 200 m from water bodies maintained.	
<b>5.8 Minimise the risk of fire as a result of the construction activities</b>					
1. Prevent veldt fires as a result of workers smoking and/or making fires for heating or cooking purpose.	Workers smoking/ starting fires (i.e. cooking, heating purposes) in undesignated areas	a) Designate smoking areas as well as areas for cooking, where the fire hazard could be regarded as insignificant.  b) Educate workers on the dangers of open and/or unattended fires.  <i>Responsibility: Construction Manager</i>	Adhoc checks to ensure workers are smoking/starting fires only in designated areas  <i>Responsibility: ECO</i>	Zero veldt fires due to smoking/heating	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
<b>5.9 On-site waste management</b>					
1. Avoid any storage of solid, liquid or hazardous waste on site and prevent waste spillages.	Solid and liquid wastes (i.e. wastewater from construction and painting activities) disposed of on the site could cause environmental problems (e.g. pollution / change in soil pH)	a) All construction waste (concrete, steel, rubbles etc.) to be removed from the site. b) Other non-hazardous solid waste (e.g. packaging material) to be disposed of at a licensed landfill. c) All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means. d) Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages. e) Waste water from construction and painting activities must be collected in a designated container and disposed off at a suitable disposal point off site.  <u>Responsibility: Construction Manager</u>	Waste removal and disposal to be monitored throughout construction  <u>Responsibility: ECO</u>	No waste storage or disposal on site; all waste disposed of as specified in the Record of Decision and relevant regulations.	The ECO to be notified within 24 hours of any waste spillage incidents on site (e.g. fuel spillage). ECO and Construction Manager to ensure necessary clean-up actions taken.
2. Ensure that wastes are managed in an environmentally friendly manner	Wastes burned/buried on site.  Dispersal of waste on site.  Wastes remaining on site after the construction phase.	a) A refuse control system will be established for the construction period to efficiently separate and remove all forms of solid waste from the site for recycling, or disposal at a licensed disposal site. b) Under no circumstances is any solid waste to be burned or buried on or in the vicinity of the site. c) Waste collection points must be sealed/enclosed to eliminate the risk of wind scatter and scavenging by wildlife.	Waste removal and disposal to be monitored daily throughout construction  <u>Responsibility: ECO</u>	Recycling of wastes where possible  Zero impact of construction wastes on the environment	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
		d) All waste products resulting from electrical installations along the road will be entirely removed from the site. <i>Responsibility: ECO</i>			
<b>5.10 Construction noise</b>					
1. Minimise noise from construction	Vehicles, earth moving and terracing of sites, construction of access roads and hard standing areas.	a) Ambient noise monitoring to be conducted at the 11 NSAs as well as any other areas the specialist bird study will identify four times during the construction period. Project proponent to appoint a qualified noise specialist.  b) Conduct noise sensitivity training for all construction staff  <i>Responsibility: Project Developer, WKN-Windcurrent to appoint noise specialist</i>	Ambient noise monitoring to be conducted at the 11 NSAs four times during the construction period.  <i>Responsibility: Project Developer, WKN-Windcurrent to appoint noise specialist</i>	SANS 10103:2008 maximum limit for ambient noise for rural areas of 45 dB(A).	None identified.
<b>5.11 Overall compliance with the conditions of the Environmental Authorisation</b>					
1. Handover the site to the project operator at the end of the construction phase, in a form that satisfies all requirements of the Environmental Authorisation for the construction phase.	Environmental conditions of approval (issued by DEA) for the construction phase are not satisfied, leading to the project operation being delayed.	a) Audit the implementation of the EMP requirements for the construction phase.  <i>Responsibility: ECO</i>	Audit report on compliance with actions & monitoring requirements in the Construction Phase EMP  <i>Responsibility: ECO</i>	Full compliance with the EMP specifications & Environmental Authorisation requirements for construction phase	None identified.

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## 6 MANAGEMENT PLAN FOR OPERATIONS PHASE

Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
1. Minimise the impact of the wind turbines on birds, caused by collisions with turbines	Poor visibility of turbines to flying birds	<p>a) Once the turbines have been constructed, post-construction monitoring as per <i>the Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa – Version 1</i> (Jenkins et al 2011) should be implemented to compare actual collision rates with predicted collision rates. If actual collision rates indicate unsustainable mortality levels, the following mitigation measures will have to be considered:</p> <ul style="list-style-type: none"> <li>• Negotiating appropriate off-set compensation for turbine related collision mortality;</li> <li>• As a last resort, halting operation of specific turbines during peak flight periods, or reducing rotor speed, to reduce the risk of collision mortality</li> </ul> <p><u>Responsibility: WKN-Windcurrent or Operations Manager to appoint bird specialist</u></p>	<p>Analyse monitoring results and compile annual monitoring report.</p> <p>Ensure that the report is made publicly available so that a database of bird monitoring impacts relevant to South African wind farms can be developed.</p> <p><u>Responsibility: Operations Manager to appoint environmental consultant</u></p>	<p>Zero bird strikes at turbine sites. This target can be revised based on monitoring data.</p> <p>The database on the effects of the WKN-Windcurrent turbines on South African species of birds contributes to the national database.</p>	None identified.
2. Minimise or avoid displacement of priority bird species due to disturbance caused by the operation of the	Priority bird species displaced by disturbance	<p>a) Post-construction monitoring should be implemented to assess the impact of displacement, particularly on priority species. Initially, a 12 month period of post-construction monitoring should be implemented, using the same protocol as is currently implemented. Thereafter, the need for further monitoring will be informed by the results of the initial 12-</p>	<p>Analyse post-construction monitoring results and compile annual monitoring report.</p> <p>Monitor the breeding activity of the pair of Secretarybirds at the site.</p>	<p>Priority bird species not displaced by disturbance.</p> <p>The breeding activity of the pair of Secretarybirds not</p>	Should the results of the post-construction monitoring indicate significant displacement of priority species, appropriate offset compensation should be negotiated with project proponent to compensate



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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
wind farm.		<p>month period. Should the results of the post-construction monitoring indicate significant displacement of priority species, appropriate offset compensation should be negotiated with developer to compensate for the loss of priority species habitat.</p> <p>b) The breeding activity of the pair of Secretarybirds at the site must be carefully monitored. If the birds actually commence with breeding at the nest site, their nesting activity must continue to be monitored throughout 2011. In the unlikely event of them re-using the nest in 2012, appropriate mitigation must be agreed upon between the avian specialist and the project proponent to ensure that the birds are not disturbed during the critical nesting period of August to October.</p> <p><u>Responsibility: WKN-Windcurrent or Operations Manager to appoint bird specialist</u></p>	<p><u>Responsibility: Operations Manager to appoint environmental consultant</u></p>	affected if they were to re-use the nest on site in 2012.	for the loss of priority species habitat.
3. Minimise the impact of the wind turbines on bat mortality caused by collisions or barotrauma	<p>Bats fly and forage in close proximity to the rotor blades.</p> <p>Bats are attracted to turbines.</p>	<p>a) Conduct carcass bat searches at a representative sample of turbines to determine the level of bat mortality around wind turbines. This is especially important during the periods April to May and August to September when bats are migrating between summer and winter roosts. Carcass searches should be made early in the morning to minimize the effect of scavengers (which remove carcasses).. It is suggested that monitoring be conducted for seven days per month for one year as per the bat monitoring guidelines (Sowler and Stoffberg, 2011).</p> <p>b) Depending on the outcome of bat monitoring</p>	<p>Analyse the bat monitoring data and re-evaluate the monitoring programme.</p> <p>Based on the bat monitoring and carcass counts, determine whether mitigation by of f-site bat boxes will off- set the mortalities. Operational management actions need to be applied to further reduce impacts on bats.</p> <p><u>Responsibility:</u></p>	<p>Create a database of bat mortalities occurring on the wind farm site.</p> <p>Thereby contribute information on the bat species occurring in the area and the impact of wind farms on bats.</p>	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
		<p>and mortality counts during operations, consider the need to increase the cut-in speed for turbines to reduce bat fatality on calm evenings.</p> <p><i>Note that this may not be economically viable for the project.</i></p> <p><u>Responsibility: Operations Manager to appoint a bat specialist</u></p>	<p><u>Operations Manager to appoint environmental consultant</u></p>		
4. Minimise visual impacts of the permanent structure and ancillary equipment	Spare parts and ancillary equipment stored in highly visible areas	<p>a) No permanent outside storage of equipment, spare parts or other ancillary materials should be visible. Keep these off-site where possible, or limited to low visibility sites.</p> <p>b) The site should be kept in a clean and well-maintained condition.</p> <p>c) The exterior of any visible surface of the turbines should be cleaned, repainted, repaired or replaced if it rusts, corrodes or otherwise visibly deteriorates.</p> <p>d) All fencing should be kept in a clean and repaired condition.</p> <p>e) All fugitive waste or debris should be collected and removed from the site and properly disposed.</p> <p>f) Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations.</p> <p>Actions that may <u>enhance</u> the positive visual aspects of the development:</p>	Annual monitoring by an environmental consultant.	Wind project has a clean and harmonious presence in the landscape.	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
		<p>a) Maintenance of the turbines is important. A spinning rotor is perceived as being useful. If a rotor is stationary when the wind is blowing it is seen as not fulfilling its purpose and a negative impression is created.</p> <p>b) Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided.</p> <p>c) An information kiosk (provided that the kiosk and parking area is located in a low visibility area) and trails along the wind farm can enhance the project by educating the public about the need and benefits of wind power.</p> <p><i>Responsibility: Operations Manager</i></p>			
5. Minimise noise impacts during operations	Noise levels exceed the SANS 10103:2008 maximum limit for ambient noise for 45dB(A) for rural areas.	<p>a) Ambient noise monitoring to be conducted at the 11 NSAs when operations commence to verify the noise emissions meet the noise rating limit.</p> <p>b) Monitoring to be done at three NSA's per year over a 3 year period to confirm that the actual noise complies with the predicted noise levels in the EIA.</p> <p>c) The monitoring to be done in the first year in the month that shows the most wind production from the historical data available.</p> <p>d) The monitoring to be done in the second year in the month that shows the least wind production from the historical data available.</p> <p>e) The monitoring to be done in the third year in the month that shows the "average" wind</p>	<p>Ambient noise monitoring at 11 NSA's when operations commence.</p> <p>Noise monitoring by a qualified noise specialist at three NSA's per year over a three year period.</p>	SANS 10103:2008 maximum limit for ambient noise for 45dB(A) for rural areas.	None identified.

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Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
		production from the historical data available. <i>Responsibility: Operations Manager</i>			

## 7 MANAGEMENT PLAN FOR DECOMMISSIONING

Objectives	Risk Sources	Actions	Monitoring	Targets	Remedial actions
1. Return the area of the turbines to its original state.	Insufficient funds to finance decommissioning and the rehabilitation necessary.	a) Develop a closure and rehabilitation plan that satisfies best practice requirements for wind farms and for habitat management. This plan should include the removal of wind farm infrastructure, with the exception of the below ground foundations.  <i>Responsibility: Operations Manager</i>	Audit the implementation of the closure and rehabilitation plan  <i>Responsibility: Operations Manager</i>	Site returned in a condition that enables ongoing agricultural activities currently undertaken on site and does not foreclose other potential options.	None identified.

## APPENDIX TO EMP

### Appendix B1: Specification Guideline for Rehabilitation

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## **1) Objectives**

- To provide guidelines for vegetation clearing and rehabilitation during all phases of wind farm construction.
- To re-vegetate areas disturbed as a direct result of the WKN-Windcurrent project in a pragmatic manner to enhance sustainable re-growth of indigenous vegetation.

## **2) Materials**

Plant species used should be those that occur naturally in the nearest site with a similar soil type and aspect. A suitably qualified botanist should be consulted with in this regard.

### **2.1. Shrubs and trees**

1. Species of special concern shall be obtained either from the site prior to clearing or from an area in close proximity to and of the same vegetation type as the site, as indicated by the Botanist.
2. Seedlings and young plants of the abovementioned plants should be collected and placed in bags to be stored in the on-site nursery before construction commences to be used during re-vegetation in consultation with an appointed horticulturalist, the ECO and a botanist.
3. Nursery plants shall be grown from locally obtained seed unless approved by the Botanist.
4. Plants shall be obtained from their natural habitat.
5. The Horticulturalist shall ensure that each plant is handled and packed in the approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on Site in a proper condition for successful growth.
6. Trucks used for transporting plants shall be equipped with covers to protect the plants from windburn. Containers shall be in a good condition. Plants shall be protected from wind during the transportation thereof.
7. No plants or plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force-feeding at any time after purchase.
8. The Horticulturalist shall ensure that the plants are in a good condition and free from plant diseases and pests. The Horticulturalist shall immediately remove plants containing any diseases and/ or pests from the Site.
9. All plants supplied by the Horticulturalist shall be healthy, well formed, and well rooted. Roots shall not show any evidence of having been restricted or deformed at any time. The potting materials used shall be weed free.
10. There shall be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they shall be maintained to ensure that the root systems remain moist.

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## **2.2. Grass**

### Sods and runners

1. Grass sods shall be clean of invasive plants or weeds.
2. Sods shall be obtained from a source approved by the Botanist. Sods rejected by the Botanist shall be removed from the site immediately.
3. Grass shall have been grown specifically for sod purposes, mown regularly and cared for to provide an approved uniformity to the satisfaction of the Botanist. It shall be harvested by special machines manufactured for this purpose to ensure an even depth of cut with sufficient root material and soil.
4. Sods shall be delivered in healthy conditions and be free from weeds and disease.
5. Sods shall be obtained from an approved nursery. Nursery sods shall have been maintained regularly to the required quality. Nursery grass sods shall have at least a 30 mm layer of topsoil.
6. Sods shall be obtained directly from the surrounding area and shall contain at least a 50 mm topsoil layer and the roots shall be minimally disturbed. They shall be obtained from the near vicinity of the site from an area selected by the Botanist. The soil shall be compatible with that removed from the area to be re-vegetated and shall not have been compacted by heavy machinery.
7. Runners shall be of an approved quality and free from disease or weeds.

### Indigenous vegetation sods

1. Sods of indigenous vegetation (e.g., rushes, sedges and grass) shall be obtained from areas approved by the Botanist, within or near the site.
2. The Horticulturalist shall identify suitable sods, as directed by the Botanist.
3. Sods rejected by the Botanist shall be removed from the site immediately.
4. Indigenous vegetation sods shall be clean of weeds or invasive plants in specified areas before planting.

### Seed

1. The seed mix quantities and purity levels shall be specified by the horticulturalist and approved by the Botanist.
2. Seed shall be utilised for the cultivation of material for revegetation.
3. Seed shall be utilised for direct sowing.
4. Seed must be pre-dried then stored under cool, dry, insect free conditions until required either for cultivation in the nursery or in the rehabilitation process. Only viable, ripe seed shall be used.
5. A record of stock relevant to the project that is held in the nursery shall be provided to the Botanist on a monthly basis.

### Harvested seed

1. Indigenous seed shall be harvested in areas which are free of alien/ invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites, as indicated by the Botanist.
2. Following harvesting, the seed shall be dried under cool airy conditions. The seed shall be insect free and shall be stored in containers under cool conditions that are free of rodents or insects. No wet, mouldy or otherwise damaged seed is acceptable.

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3. Seed harvested by hand from selected species, should be treated and stored separately.
4. Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs shall be kept apart from individually harvested seed.
5. Harvested seed obtained by means of vacuum harvesting, shall be free of excessive quantities of organic and/ or substrate material.

### **2.3. Mulch**

Mulch shall be utilised as follows depending on local and seasonal availability of material.

#### Brush-cut mulch

1. The stockpiled vegetation from the clearing operations shall be reduced to mulch.
2. Indigenous plant material shall be kept separate from alien material. The vegetative material, shall be reduced by either mechanically means (chipper) or by hand-axing to sticks no longer than 100 mm. The chipped material shall be mixed with the topsoil at a ratio not exceeding 1:1.
3. Mulch shall be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants.
4. No harvesting of vegetation outside the area to be disturbed by construction activities shall occur.
5. Mulch shall be harvested from areas in close proximity to the site, as approved by the Botanist. Any collection of indigenous material from nearby area that will not be subject to complete denudation shall only be done in mature vegetation in areas identified by the Botanist.
6. Harvesting shall be performed in a chequer board fashion, cutting the indigenous vegetation down to 100 mm above the ground, in 2 m wide strips, leaving 2 m gaps of undisturbed vegetation in between.
7. The Horticulturalist shall take every effort to ensure the retention of as much seed as possible in mulches made from indigenous vegetation. Mulches shall be collected in such a manner as to restrict the loss of seed.
8. Brush-cut mulch shall be stored for as short a period as possible, and seed released from stockpiles shall be collected for use in the rehabilitation process.

#### Wood chips

1. Wood chips (including bark) shall be utilised as mulch during re-vegetation and rehabilitation of the site.
2. The chips shall be no longer than 50 mm in length or breadth and shall be free of seed. The Botanist shall approve the source of chips.
3. The wood shall be chipped during winter
4. Chips shall not be made from wood treated with preservatives.
5. Half-composted chips shall be utilised in preference to non-composted chips
6. Indigenous seed shall always be added to wood chip mulches.

#### Compost

1. Compost shall be utilised as mulch during re-vegetation and rehabilitation of the site.
2. The compost shall be well decayed, friable and free from weed seeds, dust or any other undesirable materials.



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3. Seed free, half-composted material, such as mulled-bark, shall be used as an additive to extend indigenous mulch. No more than 50% compost shall be used under these circumstances.

#### **2.4 Slope stabilizers and anti-erosion measures**

##### Stabilisation cylinders

1. Stabilisation cylinders shall consist of cylindrical capsules approximately 125 mm in diameter by 1.5 m in length.
2. Stabilisation cylinders shall be manufactured from biodegradable material such as hessian or of extruded biodegradable plastic netting. The plastic material shall be sufficiently robust to last for a period of not less than 3 years and not more than 10 years before disintegrating under normal service conditions.
3. Stabilisation cylinders shall be filled with shredded or partly compressed pine chips or similar material. Only material passing through a 31 mm sieve with round holes and retained on a 5 mm sieve with square holes shall be used. Splinters and flat chips are not acceptable.
4. A seed approved by the Botanist shall be included in the cylinders.
5. Cylinders shall be anchored in position using biodegradable material.
6. Cylinders shall not be used to stabilise any rock faces.

##### Biodegradable netting / matting

1. Biodegradable netting/matting shall be made from jute, sisal, coir or similar material.
2. A 1 m<sup>2</sup> sample of the geofabric, geogrid or nylon (biodegradable) fabric shall be submitted to the Botanist for approval prior to procurement.
3. The netting/matting shall be sufficiently robust to last for a period of not less than 5 years under normal service conditions.
4. Holes in the netting/matting shall have a minimum size of 400 mm<sup>2</sup> and a maximum size of 900 mm<sup>2</sup> and be made from at least 4-6 mm thick cord.

##### Logs

1. For slopes of less than 1:3, the Site shall be stabilised by means of "geojute" (if available) and continuous rows of logs, secured to the slope with timber pegs, parallel to the contour. Logs shall be untreated pine (or gum) poles of not less than 150 mm with a taper of not more than 75 mm over its length. Timber pegs to be treated and not less than 400 mm in length. Timber pegs must be longer if thicker logs than the minimum are used.
2. Logs shall be secured to the slope in such a manner that they will not become dislodged during construction and/ or planting. Logs to be secured to the slope by means of a minimum of two pegs driven into the soil not less than 250 mm deep. For logs longer than 3 m, additional pegs shall be required. Log ends to be butt-jointed and plugged with wood chips or similar to prevent water from washing through at the joint. Logs shall be placed at 2 m intervals with a bottom row parallel to the edge of the road. Logging of the slope to start at the top of the slope to prevent the stretching of the "geojute".

## **2.5. Soil stabilizers**

1. Soil stabilisers shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and form an encrustation.
2. Soil stabilisers shall be of such a quality that grass and indigenous seeds may germinate and penetrate the crust. Samples of the proposed material shall be supplied to the Botanist before any of the material is delivered to the Site.

## **2.6. Topsoil and subsoil**

1. All soil imported to act as bedding material shall be free of alien plant seeds, and their use shall be restricted to 500 mm below the soil surface.

## **2.7. Boulders and rocks**

1. Boulders or rocks used in rehabilitation shall come from comparable geomorphological units to those that they are being utilised to rehabilitate.
2. Where possible, boulders and rocks utilised during rehabilitation, shall be collected from the Site and stockpiled prior to the commencement of construction activities on Site.

## **3) Infrastructural Requirements**

### Vegetation clearing

1. A plant relocation and vegetation clearing plan should be designed if appropriate before construction commences
2. Areas to be cleared of vegetation should be clearly demarcated before clearing commences.
3. Areas should only be stripped of vegetation as and when required, especially grasses, to minimize erosion risk.
4. Once demarcated the area to be cleared of vegetation should be surveyed by the vegetation clearing team under the supervision of the botanist and horticulturalist to identify and mark species suitable for rescue.
5. Plants to be rescued should include both species of special concern requiring removal for relocation as well as species that would be suitable for use in rehabilitation.
6. Depending on growth form this material should be appropriately removed from its locality and stored in the nursery holding areas or immediately relocated where it may be required elsewhere immediately.
7. Small trees and shrubs (<1 m in height) can often be rescued and planted temporarily in potting bags for later use.
8. Arboreal species (orchids) should be collected attached to the substrate (i.e. branch) they are growing on and stored (hung) in a moist, lightly shaded nursery area for later relocation.
9. Wherever possibly any seed material should be collected immediately and stored for later use, particularly species that occur in low numbers.
10. Before any earthmoving activities are commenced any ripe grass seed should be collected (using a sickle or similar implement), dried and stored for use during regressing.

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11. Comprehensive notes should be kept as to the identification, habitat, and any potential biophysical requirements of plants, and any species of special concern removed for relocation should have a GPS locality recorded.
12. Grass sods can also be collected for immediate use in any areas requiring revegetation.

Topsoil

1. Sufficient topsoil must be stored for later use during decommissioning, particularly from outcrop areas.
2. Topsoil shall be removed from all areas where physical disturbance of the surface will occur.
3. All available topsoil shall be removed after consultation with the Botanist and horticulturalist prior to commencement of any operations.
4. The removed topsoil shall be stored on high ground within the footprint outside the 1:50 flood level within demarcated areas.
5. Topsoil shall be kept separate from overburden and shall not be used for building or maintenance of roads.
6. The stockpiled topsoil shall be protected from being blown away or being eroded. The application of a suitable grass seed/runner mix will facilitate this and reduce the minimise weeds.

Road Construction

1. Should a portion of the access road be newly constructed the following must be adhered to:
  - a. Water courses and steep gradients shall be avoided as far as practical;
  - b. Adequate drainage and erosion protection in the form of cut-off berms or trenches shall be provided where necessary.
2. No other routes shall be used by vehicles or personnel for the purpose of gaining access to the site.
3. Newly constructed roads shall be adequately maintained so as to minimise dust, erosion or undue surface damage.
4. The liberation of dust into the surrounding environment shall be effectively controlled by the use of inter alia, water spraying and /or other dust-allaying agents. The speed of haul trucks and other vehicles must be strictly controlled to avoid dangerous conditions, excessive dust or excessive deterioration of the road being used.
5. The access road to the site must be strictly maintained during the operation process. Sections of the access road that erode during the construction phase shall be suitably rehabilitated upon completion of the project.

Operating Procedures in the Study Area

1. Grass and vegetation of the immediate environment, or adapted grass / vegetation will be re-established on completion of construction activities, where applicable.
2. No firewood to be collected on site and the lighting of fires must be prohibited.
3. Cognisance is to be taken of the potential for endangered species occurring in the area and appropriate measures must be implemented.

Excavations and Disturbed Areas

Whenever any excavation is undertaken, the following procedures shall be adhered to:

1. Topsoil shall be handled as described in this EMP.

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2. The construction site will not be left in any way to deteriorate into an unacceptable state.
3. Once overburden, rocks and coarse natural material have been placed in the waste pile, they will be profiled with acceptable contours (including erosion control measures), and the previous stored topsoil shall be returned to its original depth over the area.
4. The area shall be fertilised if necessary to allow vegetation to establish rapidly. The site shall be seeded with a local or adapted indigenous seed mix in order to propagate the locally occurring flora.

#### **4) Construction**

##### **4.1. Preparation of ground surfaces**

1. Prior to the application of topsoil, the ground surface shall be ripped or scarified with a mechanical ripper to a depth of approximately 150 mm.
2. Prior to the application of topsoil, the ground surface shall be ripped or scarified by hand tilling to a depth of approximately 150 mm. {this specification shall be used on small sites}
3. Compacted soil shall be ripped to a depth of greater than 250 mm. The ripped area shall be hand-trimmed.
4. The subsoil shall be thoroughly tilled to a depth of at least 100 mm by means of a plough, disc, harrow or any other approved method until the condition of the soil is acceptable, as approved by the Botanist.
5. Where tilling is difficult, the Horticulturalist shall use rotary tillage machinery until no clods or lumps larger than 40 mm in size remain, and the mixing of soil is acceptable to the Botanist.
6. In road cuttings, a weed-free gravel / sand / organic mix shall be utilised as a sub-surface layer.
7. Topsoil shall be applied.
8. Subsequent to the addition of the sub-soil, topsoil shall be spread evenly over the ripped or tilled surface to a depth of 75-150 mm on flat ground or to a minimum depth of 75 mm on slopes of 1:3 or steeper or as specified in this specification.
9. The final prepared surface shall not be smooth but furrowed to follow the natural contours of the land, with scattered rocks of varying sizes according to the natural condition of the area.
10. Where sodding is required slight scarification shall be carried out to contain the sods. The soil shall be uniformly moist to a depth of 150 mm prior to planting or seeding. If this condition is not met by rainfall, the Horticulturalist, as directed by the Botanist, shall carry out irrigation.

##### **4.2. Soil stabilization**

Various options can be utilized for soil stabilization, based on material availability.

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Straw stabilisation

1. Straw shall be utilised as a binding material in areas with deep sand, where possible.
2. Baled straw shall be placed on the cleared area, opened and spread evenly by hand or machine at a coverage rate of 1 bale per 10 m<sup>2</sup> over the area to be stabilised. It shall then immediately be rotovated into the upper 100 mm layer of soil. This operation shall not be attempted when the wind strength is such as to remove the straw before it can be rotovated into the sand.

Mulch stabilisation

1. Mulch shall be applied by hand to achieve a layer of uniform thickness. The mulch shall then be lightly worked into the topsoil layer so that it mixes with the soil and serves to bind it.
2. The mulch shall be spread at a coverage rate of 100 kg per 250 m<sup>2</sup> or 4 t/ha.
3. Where brush-cut material is to be utilised as mulch, this material shall be evenly spread across the area to a uniform depth of 25 mm. The mulch shall then immediately be rotovated into the upper 100 mm layer of soil. This operation shall not be attempted when the wind strength is such as to remove the mulch before it can be rotovated in.
4. In very rocky areas a layer of mulch shall be added prior to adding the top-material. The mulch must then be worked into the top-material to bind it.
5. Alien vegetation mulch shall be in a non-seed bearing state and shall be chipped prior to application. The preparation of alien vegetation mulch shall be done at source.
6. The Horticulturalist shall cut bush to a height of 400 mm above ground level from designated areas. This vegetation shall then be passed through the chipping machine as above, and be stockpiled for later use as mulch.
7. If the area is exposed to strong wind the mulch stockpile shall be covered with a fine nylon net with 100 mm x 100 mm openings.

Compost stabilisation

- The soil shall be stabilised by placing and lightly compacting a 75 mm layer of compost over the designated areas or by working a 75 mm layer of compost into the ground to a depth of 150 mm.

Stabilisation of steep slopes

1. The Horticulturalist shall take measures to protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. The Horticulturalist shall take any other measures that may be necessary to prevent surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
2. If runnels or erosion channels develop, they shall be back-filled and compacted, and the areas restored to a proper condition. The Horticulturalist shall not allow erosion to develop on a large scale before effecting repairs.
3. Where artificial slope stabilisers are used, these shall be applied to the slope, preferably before topsoiling, but according to the detailed construction plan and as specified in this specification.
4. Near vertical slopes (1:1 to 1:2) shall be stabilised using hard structures following specifications.

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5. Where the slopes are 1.3 to 1:6 they shall be logged or otherwise stepped (using stabilisation cylinders or similar) in order to prevent soil erosion. Logs/ cylinders must be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope. These logs/ cylinders must be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.
6. In areas where slopes are less than 1:6, horizontal grooves, shallow steps or ledges parallel to contours shall be made on the cut slopes. They shall be made at random to appear natural.
7. In areas where slopes are less than 1:6 these slopes shall be stabilised by using logs in parallel rows, or stabilisation cylinders fastened randomly into position or using biodegradable netting. These structures shall hold the top-material on the slopes and serve as erosion prevention structures.
8. Shallow slopes shall be stabilised using commercial available and approved anti-erosion compounds.

#### **4.3. Slope modification and stabilization**

##### Cut slopes adjacent to roads

1. Cut and fill slopes shall be shaped and trimmed to approximate the natural condition and contours as closely as possible and be undulating. Levels, incongruous to the surrounding landscape, shall be reshaped using a grader and other earthmoving equipment.
2. All cut and fill slopes shall be left as rough as possible, and shall contain ledges to facilitate the accumulation of topsoil. The ledges shall be dug at random to appear natural. Furthermore, the Horticulturalist shall ensure that any embedded rocks that will not pose a danger to traffic, remain on the slopes.
3. Boulders / rocks, collected on the site before disturbance, shall be scattered at a predetermined density approved by the Botanist.
4. Any eroded areas deeper than 50 mm shall be either trimmed down by back cutting the slope face or repaired to the satisfaction of the Botanist with boulders and soil or any other approved method.
5. Catchwater drains shall be installed above the cut slopes.
6. Where cut slopes are greater than 4 m in height, the Horticulturalist shall construct berms at regular intervals.
7. Natural water flow paths shall be identified and subsurface drains (using riprap or superfluous rock material) or surface drains and chutes {use water speed control structures where necessary}, preferably using cemented natural rock, shall be constructed along the flow paths.
8. Near vertical slopes (1:1 to 1:2) shall be stabilised using natural rock wall structures constructed using conventional building methods or in forms with slurry forced between the structures. All structures shall have a 'natural' look and facilities for plants to grow in.
9. Near vertical slopes (1:1 to 1:2) shall be stabilised using stacked precast concrete blocks. All structures shall have a 'natural' look and facilities for plants to grow in.
10. All areas where the slopes are 1.3 to 1:6 shall be logged or otherwise stepped (using stabilisation cylinders or similar) in order to prevent soil erosion. Logs/ cylinders shall be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart,

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depending on the steepness of the slope. These logs/ cylinders shall be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.

11. In areas where slopes are less than 1:6 horizontal groves and shallow steps and ledges parallel to contours shall be made on the cut slopes. They shall be made at random to appear natural.
12. In areas where slopes are less than 1:6 horizontal, these slopes shall be stabilised by using logs in parallel rows, or stabilisation cylinders fastened randomly into position shall be utilised. These structures shall hold the top-material on the slopes and serve as erosion prevention structures.

Blasted areas

1. Blasted areas shall be finished so as to be as rough as possible to facilitate establishment of vegetation, where revegetation will be implemented.

Trees and shrubs

1. One third of the fertiliser shall be scattered at the bottom of the hole, one third dug into the topsoil to be replaced in the hole and the remainder watered into the soil at surface level.

Basic re-grassing

1. 2:3:2 fertiliser shall be applied with the seed mix, at the rate of 400 kg/ha. Super phosphate shall be applied post germination at the rate of 200 kg/ha

## **5) Rehabilitation**

### **5.1. Rehabilitation Objective**

The overall objective of the rehabilitation plan is to minimize adverse environmental impacts whilst maximizing the future utilization of the property. The key focus for rehabilitation for this project should therefore be on areas on site that are disturbed as a direct result of the WKN-Windcurrent project.

Additional broad rehabilitation strategies / objectives include the following:

1. Rehabilitating the disturbed areas to take place concurrently within prescribed framework established in the EMP.
  - All infrastructure, equipment, plant and other items used during construction will be removed from the site
  - Waste material of any description, including scrap and rubble will be removed entirely from the site and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on site.
  - Final rehabilitation shall be completed within a specified period.

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## **5.2. Rehabilitation Plan**

The overall re-vegetation plan will be as follows:

1. Repair the aesthetic impact of the site;
2. Stabilise disturbed soil and rock faces;
3. Minimize surface erosion and consequent siltation of natural water course located on site;
4. Control wind-blown dust problems;
5. Enhance the physical properties of the soil;
6. Re-establish nutrient cycling; and
7. Re-establish a stable ecological system.

Every effort must be made to avoid unnecessary disturbance of the surrounding natural vegetation during construction operations.

### Drainage and Erosion Control

To control the drainage and erosion at site the following procedures will be adopted:

1. Areas where construction is completed should be rehabilitated immediately.
2. All existing disturbed areas will be re-vegetated to control erosion and sedimentation
3. Existing vegetation will be retained as far as possible to minimize erosion problems.

### Visual Impacts Amelioration

The overall visual impact of the proposed activity will be minimised by the following mitigating measures:

1. Re-topsoiling and vegetating all disturbed areas

### Topsoil and Subsoil Replacement

1. Topsoil and subsoil will be stripped separately from the area under construction. The topsoil and subsoil removed will be stockpiled separately and only used in rehabilitation work towards the end of the operation.
2. The vegetative cover will be stripped with the thin topsoil layer to provide organic matter to the relayed material and to ensure that the seed store contained in the topsoil is not diminished. Re-seeding may be required should the stockpiles stand for too long and be considered barren from a seed bank point of view. Stockpiles should ideally be stored for no longer than a year.
3. The topsoil and overburden will be keyed into the re-profiled surfaces to ensure that they are not eroded or washed away. The top-soiled surface will be left fairly rough to enhance seedling establishment, reduce water run-off and increase filtration.

## **5.3. Timing of planting**

1. Reseeding shall occur in late Winter (July to September).
2. Replanting shall occur during April / June.
3. Wetland preparation shall occur during Autumn and planting shall occur during early Winter after the first rains (May to June). If planting occurs in a dry late Autumn (end March) or early Winter (April to June) season it shall be necessary to irrigate plants to ensure their successful establishment.



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4. Plant material shall be planted into the ground within a maximum period of 5 days after delivery to the Site, unless otherwise specified by the Botanist.

#### **5.4. Planting guidelines**

1. Planting guidelines must be developed by a horticulturalist and/or botanist (appointed by WKN-Windcurrent) and agreed to by WKN-Windcurrent prior to the start of construction.
2. These planting guidelines should cover the following aspects
  - Re-seeding;
  - Basic re-grassing and planting of grass runners;
  - Sodding, including harvesting, planting and erosion management;
  - Sourcing, holding and planting of trees and shrubs (including indigenous species rescued from site); and
  - Planting guidelines, including protection of root systems, protection and placement of topsoil, application of fertilizers, spacing of plants, application of mulch, and watering of plants.

#### Erosion control

1. In the case of surface wash-away or wind erosion, the Horticulturalist shall implement remedial measures, as approved by Botanist, as soon as possible.
2. Appropriate erosion control/ soil stabilisation measures shall be implemented.

#### **5.5 Monitoring and Reporting**

1. Adequate management, maintenance and monitoring will be carried out annually by the applicant to ensure successful rehabilitation of the property.
2. To minimise adverse environmental impacts associated with operations it is intended to adopt a progressive rehabilitation programme, which will entail carrying out the proposed rehabilitation procedures concurrently with construction activities.

#### Inspecting and Monitoring

1. Regular monitoring of all the environmental management measures and components shall be carried out to ensure that the provisions of this programme are adhered to.
2. Ongoing and regular reporting of the progress of implementation of this programme will be done. An environmental audit shall be carried out by an independent consultant on an annual/biannual basis.
3. Inspections and monitoring shall be carried out on both the implementation of the programme and the impact on plant life.