PROPOSED CASTLE WIND ENERGY FACILITY, LOCATED NEAR DE AAR IN THE NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

Submitted as part of the
Final Environmental Impact Assessment Report
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

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: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Assessment: The process or collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

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.

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 as per the EIA Regulations. 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 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.

Department/ the competent authority: Refers to the Department of Environmental Affairs.

Development footprint: in respect of land, means any evidence of its physical transformation as a result of the undertaking of any activity.

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.

'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.

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

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 inspector: A person designated as an environmental management inspector in terms of Section 31B or 31C on the National Environmental Management Act 107 of 1998.

Environmental management programme: A 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.

Habitat: The place in which a species or ecological community occurs naturally.

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).

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

Indirect impacts: Indirect or induced changes that may occur because 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 because 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 public.

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

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 which do not require Environmental Authorisation (e.g. geotechnical surveys).

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 a constant speed of 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 nacelle to which the rotor is attached, is constructed from tubular steel or concrete. It is approximately 80 m to 120m 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 80 to 120 m tall. The tower must be strong enough to support the nacelle and blades, and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Waste: Is defined as follows:

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or
b) 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
c) 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.

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.

ABBREVIATIONS AND ACRONYMS

DEA	National Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EO	Environmental Office
GG	Government Gazette
GN	Government Notice
Ha	Hectare
I&AP	Interested and Affected Party
km^2	Square kilometres
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PM	Project Manager
SHE	Safety, Health and Environment
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited

TABLE OF CONTENTS

APPENDICES

Appendix A: Plant Rescue and Protection, and Rehabilitation Plan
Appendix B: Alien Invasive Management Plan
Appendix C: Erosion Management Plan
Appendix D: Construction Waste Guidelines
Appendix E: Grievance Mechanism for Public Complaints and Issues
Appendix F: Transportation Management Plan
Appendix G: Operational Bird Monitoring Programme
Appendix H: Operational Bat Monitoring Programme

PROJECT DETAILS *CHAPTER 1*

1.1. Overview of the Proposed Project

Castle Wind Farm (Pty) Ltd is proposing the establishment of a commercial wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the **Castle Wind Energy Facility**.

The Castle Wind Energy Facility is proposed to be located on the following farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

Infrastructure associated with the **Castle Wind Energy Facility** will include the following:

» **31 Wind turbines** with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 130m. The generating capacity of the facility will depend on the final turbine selected for implementation by Castle Wind Farm (Pty) Limited, but will not exceed 140MW.
» Turbine foundation/footprint.
» **Cabling** between turbines to be laid underground (1m deep) along the road verge where practical to connect to an on-site substation.
» Laydown area (footprint (20m x20m)).
» **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m).
» **Internal access roads** (approximately 7m wide) 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 will necessitate the construction of new access roads in some areas.
» Workshop area / office for control, maintenance and storage.

1.2. Conclusions and Recommendations of the EIA

This EMPr has been developed based on the findings of the Environmental Impact Assessment (EIA) (Savannah Environmental, 2014), and must be implemented to protect sensitive on-site and off-site features through controlling construction and

operation activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

The construction of the Castle Wind Farm will lead to permanent disturbance of an area of approximately 357 415m^2 in extent (i.e. 1.09% of the site). Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal underground internal connection cable routes and the internal access roads. From the specialist investigations undertaken for the proposed wind energy facility development site, it was concluded that the majority of impacts identified through the EIA are of moderate to low significance with the implementation of appropriate mitigation. Limited areas of potential high sensitivity were identified (refer to the sensitivity map - Figure 1.2). These potentially sensitive areas include:

- **Ecology:** The major sensitive features of the site are the larger drainage lines which are fairly well-developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered ecologically sensitive on account of their woody biomass and more mesic environment. The less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are of lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type (which is a least threatened vegetation type). The majority of the turbines are located within these lower sensitivity areas. There are 4 turbines located within the moderately sensitive rocky areas, and no turbines are located on very steep slopes or within drainage lines (i.e. within highly sensitive areas).
- **Freshwater ecosystems:** The Brak River and its larger tributaries within the study area are considered to be of a moderate to low ecological importance and Sensitivity. The ecological importance and sensitivity of the ephemeral tributaries are considered to be negligible. The ecological importance and sensitivity of the pans is very similar to that of the ephemeral streams, that is, marginal or negligible while the valley bottom wetlands are directly related to the Brak River and its larger tributaries, that is, moderate to low. There are no turbines located within the a 100m of any delineated drainage line/ streams or wetlands/pans, with the exception of turbine 5 which is approximately 50m away from a small drainage line. It is recommended that the turbine be shifted further southwards. Turbines 27 and 28 were previously located approximately 70m away from small drainage lines. However, the turbines have be relocated further away from these drainage lines as recommended by the specialist.
- **Bats sensitive areas:** Potential roosting sites are present along several drainage lines and rocky elevations found throughout the proposed study site. These areas often have favourable weather conditions which cause increases in insect abundance and thus possible increases in bat activity. No turbines are located within any of the bat high sensitivity areas and their respective buffers,

which are considered to be critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines should not be located in these areas.

» **Bird Habitat and Sensitive Areas:**
The species recorded flying most frequently on site were the Northern Black Korhaan, and Southern Pale Chanting Goshawk. The Lesser Kestrel and Amur Falcon were recorded infrequently on site, which may be as a result of low food occurrence during the monitoring programme (and these flocking species may occur in high numbers on site at some point during the lifespan of this project when food is more abundant). Due to the overall low flight activity recorded on site, the collision risk index that was developed highlighted very little in the way of spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index. Most flight activity recorded was in the flatter lower lying areas to the east, which are not targeted for turbine placement. Based on a formal risk assessment, two species emerge as being of 'medium' risk of impact by the proposed wind farm, the Northern Black Korhaan and the Southern Pale Chanting Goshawk. The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines is rated as low significance. Site sensitivity mapping has identified buffers around dams, within which no turbines should ideally be built. The Avifaunal Assessment Report identified three turbines: T3; T4; and T13 which were slightly located within the bird sensitive buffer areas. As a migratory strategy the turbines have subsequently been relocated outside the sensitivity buffer areas previously identified.

» **Heritage artefacts:** Nine sites were recorded consisting of six Stone Age sites (Site 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were recorded. Assemblages at the locations are mixed, mainly consisting of Middle Stone Age (MSA) and Late Stone Age (LSA) artefacts with some Early Stone Age (ESA) artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure. No graves were observed in the study area. Artefacts consist mostly of blades, triangular flakes (some with dorsal flaking) and cores (identified as site 9) and site also consists of a large boulder with the engravings of two elephants on it (site 6) were found located in close proximity to turbine 2, however the area can be demarcated to avoid impacts.

» **Noise sensitive receptors (NSRs):** Noise sensitive receptors do occur in and around the site. The significance of the noise impact is considered to be of a low significance for all Noise Sensitive Developments.

» **Visual receptors:** The wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the

development site. Affected farmsteads, excluding the ones located within the development site, may include: Kranskop, Klipfontein, Vendusiekraal, Disselskuil and Slingershoek. It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact. It must however be noted that a large section of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall within farms earmarked for construction of the Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility in 2015.

Impacts on the social environment are expected during both the construction phase and the operational phase of the wind farm. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the wind farm can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

No construction crew camp will be established on the site, and construction workers will be housed in the towns of De Aar, Philipstown and Hanover, or other available/existing accommodation. Construction activities on the site will be restricted to daylight hours. The construction phase is anticipated to extend over approximately 18 months. Negative impacts on the social environment during construction relate mainly to impacts due to presence of construction workers and visual impact imposed by the facility on the local environment. With the implementation of the recommended mitigation measures, negative impacts will be reduced to be of medium to low significance, and are therefore considered acceptable.

There will be a positive impact due to employment creation, which is a much needed relief by the Emthanjeni Local Municipality and Renosterberg Local Municipality (which have high unemployment levels). The positive impact due to employment creation will be lower than during operation as there will be a limited number of staff required compared to the construction phase. The potential negative social impacts of the proposed development are offset by the potential positive impacts. With the implementation of the recommended enhancement measures, positive impacts will be of medium to high significance, and are therefore considered acceptable.

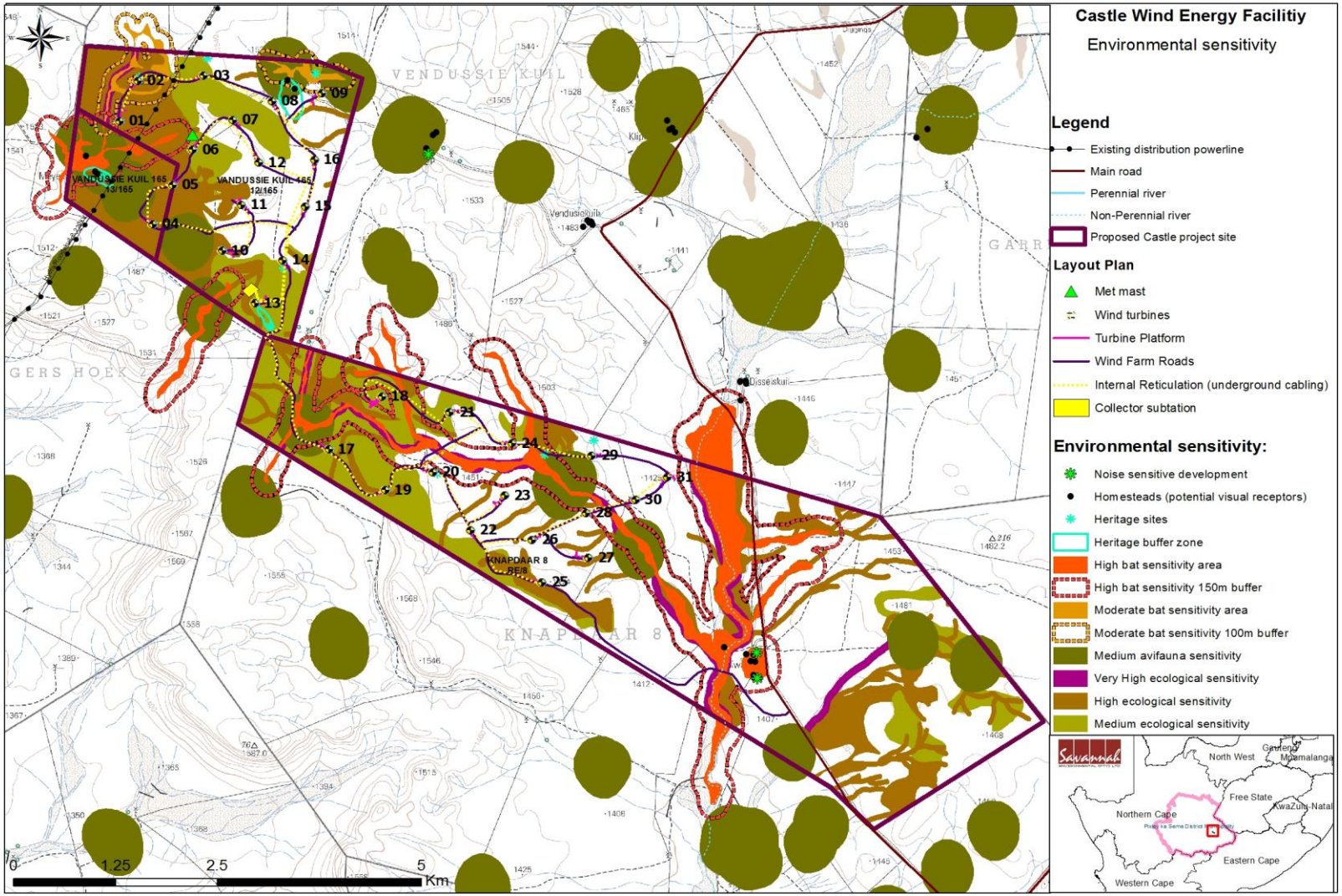

Figure 1.1: Sensitivity map for the Castle Wind Energy Facility site showing areas of high ecological, avifauna, bat, heritage and visual sensitivity (refer to Appendix P for an A3 map).

1.3. Activities and Components associated with the Facility

The main activities/components associated with the Castle Wind Energy Facility are detailed in Table 1.1.

Table 1.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity/Project Component	Components of Activity	Details
	Planning	
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey and confirmation of the infrastructure micro-siting footprint; » Survey of internal access routes; and » Survey of on-site substation.	» All surveys are to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). Establish internal access roads: 7m wide permanent roadway within the site between the turbines for use during construction and operation phase. » Temporary track for use during construction phase only.	» Access roads will be constructed/upgraded 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. » 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. » The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as specialist surveys). To accommodate the large crawler crane required for turbine assembly, a temporary track of up to 11 m in width is required to be established on the site. Permanent roads are expected to be up to 7m in width.
Undertake site preparation	» Site establishment of offices / workshop with ablutions and stores, contractors yards.	» 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
	» Establishment of internal access roads (permanent and temporary roads). » Clearance of vegetation at the footprint of each turbine. » Excavations for foundations.	
Establishment of lay down and hardstand areas on site	» Lay down areas (temporary footprint) at each turbine position for the storage of wind turbine components » Hardstand areas for crane lifting equipment. » Temporary lay down area for crane assembly. » Construction site offices.	» Each turbine needs a flat lay down area during the construction process for the storage of wind turbine components. This area can be rehabilitated after construction unless required during operation. » The hardstand area will need to accommodate the cranes required in tower/turbine assembly. Hardstand and lay down areas will be required to be established for the normal civil engineering construction equipment which will be required on site. A large hardstand area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations at each turbine location (final dimensions to be defined by geotechnical survey of the site).	» Foundation holes will be mechanically excavated (with blasting being utilised only where required). » Shoring and safety barriers will be erected around open excavation. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities.
Transport of components and equipment to site	» Flatbed trucks will be used to transport all components to site: » The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks,	» Turbine units consist of a tower comprised of typically 4 segments, a nacelle, rotor and three blades. » 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.

Main Activity/Project Component	Components of Activity	Details
	graders, compaction equipment, cement mixers, etc.). » The components required for the establishment of the substation (including transformers) * Components required for the establishment of the power line (including towers and cabling)	» 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). » The wind turbine, including tower, will be brought to site by the supplier 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 trucks will be used for the transport of each turbine.
Erect turbines	» Large lifting crane used for lifting of large, heavy components » 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. » The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. » 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. » It will take approximately 2-4 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free

Main Activity/Project Component	Components of Activity	Details
		day will be required for the installation of the rotor.
Construct substations and associated ancillary infrastructure.	» New 132 kV **substation** will be connected to the proposed 132 kV overhead power line which will connect to the newly constructed Ilanga Lethemba Substation (Solar Capital Substation) or alternatively into the Hydra Substation. » Substation components. » Security fencing around high-voltage (HV) Yard. » Workshop.	» Will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. » A lay down area for building materials and equipment associated with these buildings will also be required. » The on-site substations will be constructed with a HV yard footprint of up to 100 m x 100 m. » The substation would be constructed as follows: * Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of the wind turbines to the on-site substations	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substations.	» The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables would follow the internal access roads as far as reasonably possible.
Connect substations to power grid[1]	» A new 132kV overhead power line feeding into the power grid	» The route for the power lines will be assessed, surveyed, and pegged prior to construction. » A servitude of approximately 32 m will be required for each of the power lines.
Commissioning of the facility	» Wind Energy Facility commissioning	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make

[1] An application for a separate basic assessment process for the power line has been submitted to the DEA.

Main Activity/Project Component	Components of Activity	Details
		sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site rehabilitation	» Remove all construction equipment from the site. » 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 Renewable Energy Facility will be monitored remotely. » No permanent staff will be required on site for any extended period. It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities.
Maintenance	Maintenance activities include: » Oil and grease – turbines; » Transformer oil – substation; and » 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. » The turbine infrastructure is expected to have a lifespan of approximately 25 - 30 years, with maintenance.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform)	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate

Main Activity/Project Component	Components of Activity	Details
	» Mobilisation of construction equipment	technology/infrastructure available at that time.
Disassemble wind 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. » 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).

PURPOSE AND OBJECTIVES OF THE EMPR *CHAPTER 1*

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 EMPr 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 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 Castle 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 tools for assisted 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.

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

» 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 and frequency 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.

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.

Castle 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 Castle Energy Wind Facility, it is important that this document be read in conjunction with the Scoping Report (November 2013) and EIA Report (November 2014), as well as the Environmental Authorisation (once issued). This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMPr for construction and operation activities has been compiled in accordance with Section 33 of the EIA Regulations 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.

STRUCTURE OF THIS EMPR *CHAPTER 3*

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

- Planning and design activities
- Construction activities
- Operation activities
- Decommissioning activities

These chapters set out the procedures necessary for the developer to achieve environmental compliance. For each of the phases of implementation 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 programme 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 EMP table for each objective is illustrated below:

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

Project component/s	List of project components affecting the objective, i.e.: » Wind turbines » Access roads » Substations
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	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 throughout the life of the facility 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 and additional measures are required to be included in the EMPr to prevent deterioration or further deterioration of the environment.
» 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.

Any amendments must be approved by the Competent Authority (i.e. DEA) prior to implementation, unless these are required to address an emergency situation.

3.1. Project Team

This EMP was compiled by:

EMP Compilers	
Tebogo Mapinga	Savannah Environmental
Karen Jodas	Savannah Environmental
Input from Specialists	
Ecology	Simon Todd of Simon Todd Consulting
Avifauna	Jon Smallie of WildSkies Ecological Services
Bats	Werner Marias of Animalia
Soils, erosion and agricultural potential	Johan van Tol of HydroPedological Solutions
Visual	Lourens du Plessis of MetroGIS
Heritage	Jaco van der Walt of Heritage Contracts and Archaeological Consulting CC

Palaeontology	Barry Millsteed
Noise	MENCO
Social Impact	Tony Barbour (Environmental Consultant and Researcher)
Freshwater	Tony Belcher and Dana Grobler (Blue Science)

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes for more than ten (10) years. They have managed and drafted Environmental Management Programmes for other power generation projects throughout South Africa, including numerous wind and solar energy facilities.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: PRE-CONSTRUCTION CHAPTER 4

4.1. Goal for Pre-Construction

Overall Goal for Pre-Construction (Planning and Design): Undertake the pre-construction (planning and design) phase of the Wind Energy Facility in a way that:

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements
» Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the project.
» Enables the wind energy facility construction activities to be undertaken without significant disruption to other land uses in the area.

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

4.2. Objectives

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

From the specialist investigations undertaken for the proposed Castle Wind Energy Facility development site, areas of high sensitivity were identified (refer to Figure 1.1). The major sensitive features of the site are the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered sensitive on account of their woody biomass and more mesic environment, while the less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type. Although the majority of turbines are located within these lower

sensitivity areas, there are some turbines located within the moderately sensitive rocky areas. No turbines are located on very steep slopes or within drainage lines.

Nine heritage sites were recorded within the study area consisting of six Stone Age sites (Site 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were recorded. Again, assemblages at the locations are mixed, mainly consisting of Middle Stone Age (MSA) and Late Stone Age (LSA) artefacts with some Early Stone Age (ESA) artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure. No graves were observed in the study area. The nine heritage sites will not be impacted on by the proposed development.

Project component/s	» Wind turbines » Access roads » Substation
Potential Impact	» Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	» Positioning of turbines and access roads » Positioning of substation
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, ecology, avifauna, bats, palaeontological sites and heritage sites, as detailed within the EIA report and relevant appendices.	Engineering Design Consultant / turbine supplier Castle Wind Farm (Pty) Ltd	Tender design, design review stage
As far as possible, access roads and cable trenches which could potentially impact on sensitive areas should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.	Engineering Design Consultant Castle Wind Farm (Pty) Ltd	Tender design, design review stage
Align underground cables and internal access roads as far as possible along existing infrastructure and disturbances. Any access roads adjacent to a wetland feature should also remain outside of the 75m buffer zone as far as possible	Castle Wind Farm (Pty) Limited	Design
A buffer of at least 35m (from centre of stream for a smaller drainage lines and from the top of a	Castle Wind Farm (Pty) Limited	Design

Mitigation: Action/control	Responsibility	Timeframe
bank for larger tributaries) should be maintained adjacent to the identified freshwater features, and 75m for the pans and wetland areas.		
A walk-though survey of final infrastructure positions for the wind energy facility and associated infrastructure (including the power line) should be undertaken by a specialist ecologist and heritage specialist prior to the commencement of construction. The EMPr for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMPr must be submitted to DEA for approval prior to the commencement of construction.	Specialists	Final design phase
Should the layout (or type of wind turbines used) change significantly during the final design, the new layout must be submitted to the Department and it is recommended that the new layout be remodelled/reviewed in terms of the potential environmental impacts by an independent acoustics specialist.	Castle Wind Farm (Pty) Ltd	Design phase
A detailed geotechnical investigation is required for the design phase for all infrastructure components.	Castle Wind Farm (Pty) Ltd	Design phase
Implement a stormwater management plan for hard/compacted surfaces (e.g. substation footprints) as part of the final design of the project (see Appendix J)	Castle Wind Farm (Pty) Ltd	Design phase
Make use of existing roads where possible when planning the access road layout for the facility.	Relevant specialists Castle Wind Farm (Pty) Ltd ECO/Contractor	Design phase
Obtain any additional environmental permits required (e.g. water use license, protected tree and protected plant permits, etc.). Copies of permits/licenses must be submitted to the Director: Environmental Impact Evaluation at the DEA.	Castle Wind Farm (Pty) Ltd	Design phase
Mining permit/license to be obtained for any borrow pits to be established for the project (if applicable).	Castle Wind Farm (Pty) Ltd	Design phase
Obtain required abnormal load permits for transportation of project components to site.	Castle Wind Farm (Pty) Ltd /contractor	Design phase
The noise emission specifications of wind turbine generators should be considered when selecting the equipment in order to ensure that noise	Castle Wind Farm (Pty) Ltd	Design phase

Mitigation: Action/control	Responsibility	Timeframe
impacts are minimised as far as possible.		
Compile a comprehensive storm water management plan for hard surfaces as part of the final design of the project. This must include appropriate means for the handling of stormwater within the site, e.g. separate clean and dirty water streams around the plant, install stilling basins to capture large volumes of run-off, trapping sediments, and reduce flow velocities (i.e. water used when washing the mirrors), as well as appropriate drainage around the site.	Castle Wind Farm (Pty) Ltd	Design phase
Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.	Castle Wind Farm (Pty) Ltd	Design phase
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.	Castle Wind Farm (Pty) Ltd	Design
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass. In addition, the possibility of motion activated security lighting should be investigated. This will allow for a predominantly dark site to be lit only as required.	Castle Wind Farm (Pty) Ltd	Design
Aviation warning lights must be planned 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.	Castle Wind Farm (Pty) Ltd	Design
ECO to be appointed prior to the commencement of any authorised activities. Once appointed the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring at the DEA.	Castle Wind Farm (Pty) Ltd	Pre-construction
Identify potential opportunities for local businesses.	Castle Wind Farm (Pty) Limited	Tender Design and Review stage
Develop a database of local BEE service providers and ensure that they are informed of relevant tenders and job opportunities.	Castle Wind Farm (Pty) Limited	Pre-construction
This EMP and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Castle Wind Farm (Pty) Limited	Tender process

Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
Monitoring	» 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.

OBJECTIVE 2: To ensure effective communication mechanisms

On-going communication with affected and surrounding landowners is important to maintain during the construction and operational phases of the wind energy facility. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project component/s	» Wind turbines » Access roads » Substation
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with construction » Activities associated with operation
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public (as outlined in Appendix E) to be implemented during both the construction and operational phases of the facility. This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues.	Castle Wind Farm (Pty) Ltd	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	Castle Wind Farm (Pty) Ltd	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaison with landowners is to be undertaken	Castle Wind Farm	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
prior to the commencement of construction in order to agree on landowner-specific conditions during construction and maintenance.	(Pty) Ltd	

Performance Indicator	» Effective communication procedures in place for all phases as required.
Monitoring	» An incident reporting system should be used to record non-conformances to the EMPr. Grievance mechanism procedures should be implemented.

MANAGEMENT PLAN FOR WIND ENERGY FACILITY: CONSTRUCTION CHAPTER 5

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

As the Proponent, Castle Wind Farm (Pty) Limited must ensure that the implementation of the proposed project complies with the requirements of 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. Castle Wind Farm (Pty) Limited will retain various key roles and responsibilities during the construction of the wind energy facility. These are outlined below.

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environmental Representative; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

» Ensure of 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 Castle Wind Farm (Pty) Limited and its Contractor(s) are made aware of all stipulations within the EMPr.

» Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully conversant with the Environmental Impact Assessment for the project, the EMPr, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Castle Wind Farm (Pty) Limited 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 (once issued).
» Be fully knowledgeable with the contents of the Environmental Management Programme.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» 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 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.

The **Safety, Health and Environmental Representative** (ER) will:
» Develop and compile environmental policies and procedures.
» Direct and liaise with the Environmental Control Officer (ECO) regarding monitoring and reporting on the environmental performance of the construction phase.
» Conduct internal environmental audits and co-ordinate external environmental audits.
» Liaise with statutory bodies on environmental performance and other issues as required.

An independent **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of the EMP and the conditions of the Environmental Authorisation. Accordingly, the ECO will:
» Be fully knowledgeable with the contents with the Environmental Impact Assessment.
» Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).

- Be fully knowledgeable with the contents with the Environmental Management Programme.
- Be fully knowledgeable of all the licences and permits issued to the site.
- Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- Ensure that the contents of this EMPr 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 if the EMPr conditions or specifications are not followed then appropriate measures are undertaken to address any non-compliances (for example an ECO may cease construction or an activity to prevent a non-compliance from continuing).
- Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- Ensure that activities on site comply with all relevant environmental legislation.
- Remedial action will be required by the responsible party in the event of contravention of the specifications of the EMPr.
- Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
- Ensure that there is communication with the Site Manager regarding the monitoring of the site.
- Ensure that any non-compliance or remedial measures that need to be applied are reported.
- Keep record of all activities on site, problems identified, transgressions noted and a schedule of tasks undertaken by the ECO in the form of a daily diary.
- Independently report to DEA in terms of compliance with the specifications of the EMP and conditions of the Environmental Authorisation (once issued).

As a general mitigation strategy, the Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter weekly site compliance inspections would probably be sufficient. However, in the absence of the ECO, there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills. 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 all environmental management specifications contained within this EMPr (and the Environmental Authorisation, once issued), as well as any specific specifications detailed by Castle Wind Farm (Pty) Limited.
» Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the 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 EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

Contractor's Safety, Health and Environment Representative: The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor, must be a suitably qualified individual appointed to be 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 SHE 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 Safety, Health and Environment Representative should:
» 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

In order to meet the goal outlined in Section 5.1, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE 1: 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.

Project component/s	» Wind turbines » Access roads » Substation » Service building
Potential Impact	» Hazards to landowners/public » Security of materials » Substantially increased damage to natural vegetation
Activities/risk sources	» Open excavations (foundations and cable trenches) » Movement of construction vehicles in the area and on-site
Mitigation: Target/Objective	» To secure the site against unauthorised entry » To protect members of the public/landowners/residents

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the ECO.	Contractor	During site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area and implement access control procedures.	Contractor	During site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	During site establishment Maintenance: for duration of Contract

Mitigation: Action/control	Responsibility	Timeframe
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 located in areas of low sensitivity within the approved development area.	Contractor	During site establishment

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

OBJECTIVE 2: 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	» Construction activities associated with the establishment of the wind energy facility, including associated infrastructure.
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	» The appointed contractor should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled

	job categories. » Castle Wind Farm (Pty) Limited 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.	Contractor	Construction
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local employment target is met.	Contractor	Pre-construction

Performance Indicator	» Source as many local labourers as possible. » Database of potential local BEE services providers in place before construction phase commences.
Monitoring and Reporting	» Castle Wind Farm (Pty) Limited and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » 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 3: 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 and establishment activities associated with the establishment of the wind energy facility, including associated infrastructure.
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. » 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. » 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. » 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
Employ as many workers (skilled, semi-skilled / low-skilled) from the local area as possible. This should be included in the tender documents. Construction workers should be recruited from the local area in and around the towns such as Sutherland.	Contractor	Identify suitable local contractors prior to the tender process

Mitigation: Action/control	Responsibility	Timeframe
		for the construction phase.
Establish contact with the adjacent farmers and develop a Code of Conduct for construction workers. 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. Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Castle Wind Farm (Pty) Limited Contractor	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.	Castle Wind Farm (Pty) Limited and contractors	Construction
No housing of construction workers on the site to be permitted, apart from security personnel.	Contractors	Construction
Implement a policy that no employment will be available at the gate.	Contractors	Construction
Compensate farmers / community members for cost for any losses, such as livestock, damage to infrastructure etc proven to be associated with the project.	Contractors	Construction

Performance Indicator	» Employment policy and tender documents that set out requirement for local employment and targets completed before construction phase commences. » Code of Conduct developed and approved prior to commencement of construction phase. » Labour locally sourced, where possible. » Tender documents for contractors include recommendations for construction camp. » All construction workers made aware of Code of Conduct within first week of being employed. » Briefing session with construction workers held at outset of construction phase.
Monitoring and Reporting	» Castle Wind Farm (Pty) Limited and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on

	site.

OBJECTIVE 4: 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	» Construction of turbine (foundation, tower, nacelle and rotor) » Substation » access roads
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. » Ensure that maximum noise levels at potentially sensitive receptors be less than 65 dBA. » Prevent the generation of a disturbing or nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with the Noise Control Regulations

Mitigation: Action/control	Responsibility	Timeframe
Where possible, construction work should be undertaken during normal working hours (06H00 – 18H00), from Monday to Friday. If work is required on the weekend / public holiday, agreements can be reached (in writing) with the landowners adjacent to the work, these working hours can be extended.	Contractor	Construction
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.	Contractor	All phases of project

Mitigation: Action/control	Responsibility	Timeframe
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: » Description of activity to take place » Estimated duration of activity » Working hours » Contact details of responsible party	Contractor	At least 2 days, but not more than 5 days before activity is to commence

Performance Indicator	» No complaints received concerning noise. » Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Maximum noise levels at potentially sensitive receptors are less than 65 dBA.
Monitoring and Reporting	» Should a compliant about noise be reported, Castle Wind Farm (Pty) Limited 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 EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 5: 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.

Project component/s	» wind turbines » access roads » substation
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

Mitigation: Action/control	Responsibility	Timeframe
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 Site Manager. 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

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

OBJECTIVE 6: 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.

Project component/s	» wind turbines » access roads » substation » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas). » All other infrastructure
Potential Impact	» Erosion and soil loss » Negative impacts on wetlands » Disturbance to or loss of wetland/pan habitat » Sedimentation of watercourses/wetland areas » A loss of indigenous vegetation cover » Increased runoff into drainage lines can potentially be associated with accelerated erosion
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Stormwater run-off from sealed surfaces » Mobile construction equipment movement on site » River/stream/drainage line road crossings » Roadside drainage ditches » Project related infrastructure, such as buildings, turbines and fences
Mitigation: Target/Objective	» To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines » To minimise damage to vegetation by erosion or deposition » To minimise damage to rock, soil and vegetation by construction activity » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover » No reduction in the surface area of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure

	» Minimal loss of vegetation cover due to construction related activities » No or insignificant loss of wetland area in the specialist study area » No increase in runoff into drainage lines as a result of construction of project related infrastructure » 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 / 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 areas.	Contractor	Erection: Before construction Maintenance: Duration of contract
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 / Contractor	Before and during construction

Mitigation: Action/control	Responsibility	Timeframe
Control depth of all excavations and stability of cut faces/sidewalls.	Engineer / 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.	Contractor	Compile during design; implement during construction & operation
Cement batching to take place in designated areas only, as approved on site layout (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

Performance Indicator	» No activity outside of designated areas » Minimal level of soil erosion around site as a result of construction activities » Minimal level of increased siltation in drainage lines as a result of construction activities » Minimal level of soil degradation as a result of construction activities
Monitoring and Reporting	» Continual inspections of the site by ECO » Fortnightly inspections of sediment control devices by ECO » On-going inspections of surroundings, including drainage lines and wetlands by ECO » Reporting of ineffective sediment control systems and rectification as soon as possible. » An incident reporting system must record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 7: 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 cross identified wetland areas. Mitigation measures are required to minimise impacts on those systems affected in this regard.

Project component/s	» access roads » cabling
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
Rehabilitate any disturbed areas as soon as possible once construction is completed in an area.	Contractor	Construction
Control stormwater and runoff water. Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams.	Contractor	Construction
For any new construction where direct impacts on wetlands are unavoidable cross watercourses perpendicularly to minimise disturbance footprints.	Contractor	Construction
Construction must not result in the width of the watercourse being narrowed.	Contractor	Construction
Utilise erosion control measures on access roads, wetland areas and drainage lines where required.	Contractor	Construction
Ablution facilities at the construction sites must be located at least 100m away from the river system and regularly serviced	Contractor	Construction
Concrete batching plants and stockpiles to be located more than 500m away from wetlands.	Contractor	Construction

Performance Indicator	» No impacts on water quality, water quantity, wetland vegetation, natural status of wetland
Monitoring and Reporting	» Habitat loss in watercourses should be monitored before and after construction. » 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 8: Limit disturbance of vegetation and loss of protected flora during construction

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.

Project component/s	All infrastructure and activities which result in vegetation loss or clearing including: » Clearing for roads and excavation for turbine foundations » Underground cabling » Access roads
Potential Impact	» Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants
Activity/risk source	Vegetation clearing for the following: » Turbine construction and service areas » Access roads » Laydown areas » Construction Camps
Mitigation: Target/Objective	» To reduce the footprint and low impact on terrestrial environment » To reduce the impact on protected plant species

Mitigation: Action/control	Responsibility	Timeframe
Preconstruction walk-through of development footprint and use micro-siting to reduce local impact.	Specialists	Construction
Affected individuals of protected species which cannot be avoided should be translocated to a safe area on the site prior to construction. This does not include trees which cannot be translocated, which should be trimmed to a height of 0.5m rather than removed completely.	Specialist	Construction
Revegetation of cleared areas or monitoring should be implemented to ensure that recovery is taking place	Contractor	Construction
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible once construction is complete in an area » Do not import soil from areas with alien plants	Contractor	Construction & Operation

Mitigation: Action/control	Responsibility	Timeframe
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	Construction & Operation
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction & Operation

Performance Indicator	» Vegetation loss must be restricted to infrastructure footprint » Low impact on protected plant species » A permit must be obtained for the destruction or translocate affected individuals of protected species.
Monitoring and Reporting	ECO to monitor construction to ensure that: » Vegetation is cleared only within essential areas » Erosion risk is maintained at an acceptable level through flow regulation structures where appropriate and the maintenance of plant cover wherever possible

OBJECTIVE 9: Protection of fauna & avifauna

Infrastructure associated with the facility often impacts on birds and animals. New roads constructed will also have a disturbance and habitat destruction impact.

Project component/s	» wind turbines and associated laydown areas » access roads and cabling » substation » workshop area » batching plants » temporary laydown areas » associated access road
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats » Disturbance of birds
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment
Mitigation: Target/Objective	» To minimise footprints of habitat destruction » To minimise disturbance to resident and visitor faunal and avifaunal species

Mitigation: Action/control	Responsibility	Timeframe
Clearly mark areas to be cleared in order to eliminate unnecessary clearing/disturbance.	Contractor in consultation with	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
	Specialist	
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
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Minimum disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna » 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 » Supervision of all clearing and earthworks by ECO » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 10: 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 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.

Project component/s	» wind turbines » access roads and cabling » Operations and service building area » substation » associated access roads
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed » Loss of fossil resources
Activity/risk source	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » Access road construction activities » 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.	Specialist EO	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.	Contractor in consultation with Specialist	Duration of contract
Should any fossil materials be identified during the construction phase a palaeontologist should be appointed to evaluate its significance.	Contractor in consultation with Specialist	Construction
Deeper excavations such as those associated with the foundations for the wind turbines must be regularly inspected by a palaeontologist during their excavation.	Specialist	Construction
If at any stage during the construction phase any scientifically or culturally significant fossil material exist, it would be vital to recover the fossil and report the occurrence to the geological staff at the closest repository in the Eastern Cape / Northern Cape (e.g. 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
If concentrations of archaeological materials are exposed during construction then all work must stop for an archaeologist to investigate.	Contractor	Construction
At Site 9 surface sampling should be conducted and the	Specialist	Construction

Mitigation: Action/control	Responsibility	Timeframe
site should be monitored during construction. Stone Age Materials were identified close to turbine 2 and 29. The area should be demarcated or alternatively the engravings must be traced and documented and relocated to a museum.		
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
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	Construction

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

OBJECTIVE 11: 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.

Project component/s	» Construction site » access roads » Wind turbines
Potential Impact	» The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation.

	» 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 » 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, matt, non-reflective colour (i.e. off white, 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
Ensure all disturbed areas are appropriately rehabilitated once construction in an area is complete.	Contractor	Duration of construction

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

OBJECTIVE 12: 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.

Project	» wind turbines

component/s	» substation » concrete batching plant
Potential Impact	» Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Vehicles associated with site preparation and earthworks » Power line construction activities » Substation construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » 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 » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons » To comply with waste management legislation » To minimise production of waste » To ensure appropriate waste storage and disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
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	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
or oils.		
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 review at any time.	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 detailing the quantity, nature and fate of any hazardous waste.	Contractor	Duration of contract
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	Contractors	Erection: during site establishment

Mitigation: Action/control	Responsibility	Timeframe
waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.		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 and concrete 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

Performance	» No chemical spills outside of designated storage areas

Indicator	» No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » 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. » 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. » Observation and supervision of waste management practices throughout construction phase. » Waste collection to be monitored on a regular basis. » Waste documentation completed. » An incident reporting system must be used to record non-conformances to the EMP. » The appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

OBJECTIVE 13: 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.

Project component/s	» Wind energy facility » Associated infrastructure
Potential Impact	» Pollution/contamination of the environment » Disturbance to the environment and surrounding communities
Activity/risk source	» Contractors are not aware of the requirements of the EMP, 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
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting must be permitted outside the designated	Contractor (and sub-contractor/s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
area. These facilities must be regularly serviced by appropriate contractors. Ablution facilities must not be placed within 100m from any river, wetland or drainage line.		
Cooking must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
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

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMPr. » No complaints regarding contractor behaviour or habits. » 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. » 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. » An incident reporting system must be used to record non-conformances to the EMPr.

OBJECTIVE 14: To avoid and or minimise the potential risk of increased veld fires during the construction phase.

Project component/s	» Wind energy facility and associated infrastructure
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 firefighting 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

Performance Indicator	» Designated areas for fires identified on site at the outset of the construction phase. » Firefighting equipment and training provided before the construction phase commences. » 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. » An incident reporting system must be used to record non-conformances in the EMPr.

5.4. Detailing Method Statements

OBJECTIVE 15: 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 and ECO.

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:

- 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.

The Contractor may not commence the activity covered by the Method Statement until it has been approved, 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.

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

OBJECTIVE 16: 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.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
» Awareness of any other environmental matters, which are deemed necessary by the ECO.
» Ensuring that appropriate communication tools are used to outline the environmental "do's" and "don'ts" (as per the environmental awareness training course) to employees.
» Records must be kept of those that have completed the relevant training.
» Refresher sessions must be held to ensure the contractor's staff are aware of their environmental obligations.

5.6. Monitoring Programme: Construction Phase of the Renewable Energy Facility

OBJECTIVE 17: 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 EMP 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.

Bird and/or bat monitoring should take place in line with guidelines or endorsed standards in South Africa, at the time of implementing the wind energy facility (refer to **Appendix H** for methodology as provided by the avifauna specialist contracted through the EIA). Where this is not clearly dictated, Castle Wind Farm (Pty) Ltd will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

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
- Aid communication and feedback to authorities and stakeholders

The Environmental Control Officer (ECO) will monitor 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.

MANAGEMENT PLAN FOR WIND ENERGY FACILITY: REHABILITATION OF DISTURBED AREAS CHAPTER 6

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

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

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

6.2. Objectives

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 1: 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.

Project component/s	» wind energy facility (including temporary access roads and laydown areas) » substation » 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 » Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas » 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 should 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
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.	Castle Wind Farm (Pty) Limited 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.	Castle Wind Farm (Pty) Limited in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	» All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and at least 40% plant cover achieved on rehabilitated sites over a period of 2 to 5 years. » 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. » On-going alien plant monitoring and removal should be undertaken on an annual basis. » An incident reporting system must be used to record non-conformances to the EMPr.

MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: OPERATION CHAPTER 7

An environmental manager should be appointed during operation whose duty it will be to minimise impacts on surrounding sensitive habitats, including wetlands. In addition, it is important to monitor the incidence of bird collisions with the wind turbines, as well as bat fatalities. Should any significant impacts of the facility on priority bird or bat populations be detected by the monitoring programmes, mitigation could be required to be investigated for those selected problem turbines.

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 1: 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.

Project component/s	» Wind turbines » access roads » substation » 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 » 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.	Castle Wind Farm (Pty) Limited	Operation
Post information boards about public safety hazards and emergency contact information	Castle Wind Farm (Pty) Limited	Operation

Performance Indicator	» Site is secure and there is no unauthorised entry » No members of the public/ landowners injured
Monitoring and Reporting	» Regular visual inspection of fence for signs of deterioration/forced access » 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 2: Limit the ecological footprint of the facility

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.

Project component/s	» Areas requiring regular maintenance » Route of the security team » Areas disturbed during the construction phase and subsequently rehabilitated at its completion
Potential Impact	» Disturbance to or loss of vegetation and/or habitat » Alien plant invasion » 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. » 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.	Castle Wind Farm (Pty) Ltd	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Castle Wind Farm (Pty) Ltd	Operation
Vegetation control within the facility should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner	Castle Wind Farm (Pty) Ltd/ Specialist	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Castle Wind Farm (Pty) Ltd	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified	Castle Wind Farm (Pty) Ltd /Specialist	Annual monitoring until successful re-establishment of vegetation in an area

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats » No erosion problems within the facility or along the power line route » Low abundance of alien plants within affected areas » Maintenance of a ground cover of perennial grasses and forbs that resist erosion » Continued improvement of rehabilitation efforts
Monitoring	» Observation of vegetation on-site by environmental manager. » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas » Annual monitoring with records of alien species presence and clearing actions » Annual monitoring with records of erosion problems and mitigation actions taken with photographs

OBJECTIVE 3: Protection of avifauna, priority bird species and bat species

During operation of the facility, the threat of collision of birds and bats with the turbine blades is a concerning issue. 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 and bat interactions have been monitored. Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Bird monitoring to be undertaken during the operation of the facility.

Project component/s	» wind energy facility (turbines) » substation
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades » Disturbance to or loss of bats as a result of collision with turbines and/or barotrauma » Electrocution and collision with the power line
Activity/risk source	» Spinning turbine blades » Substation
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind energy facility on priority bird species » Minimise impacts associated with the substation

Mitigation: Action/control	**Responsibility**	**Timeframe**
A site monitoring programme must be implemented for surveying bird and bat movements in relation to the wind energy facility and fully documenting all collision and electrocution casualties with the turbines and associated power line.	Castle Wind Farm (Pty) Ltd / environmental manager	Operation
Start post-construction bird and bat monitoring as soon as possible for turbines (for birds).	Monitoring agency	Once facility is operational
Periodically collate and analyse post-construction monitoring data for bird monitoring.	Advising scientist/biologist	Every 3 months of monitoring
Review bird and bat monitoring report on the full year of post-construction monitoring, and integrate findings into operational EMPr and broader mitigation scheme.	Advising scientist/biologist, monitoring agency	1 year post-construction

Performance Indicator	» Minimal additional disturbance to bird or bat populations on the wind energy facility site. » Continued improvement of bird and bat protection devices, as informed by the operational monitoring. » Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and bats and the proposed/ operating wind energy facility. » 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 » The monitoring team to monitor turbine field for fatalities. » Review of bird monitoring report on the full year of post-construction monitoring

OBJECTIVE 4: Minimisation of visual impact

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.

Project component/s	» Wind energy facility (including access roads) » Substation
Potential Impact	» Risk to aircraft in terms of the potential for collision » Enhanced visual intrusion
Activity/risk source	» Substation and associated lighting » Wind turbines and other infrastructure
Mitigation:	» To minimise potential for visual impact

Target/Objective	» 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 » 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**
Maintain the general appearance of the facility in an aesthetically pleasing way.	Castle Wind Farm (Pty) Ltd	Operation and maintenance
Undertake regular maintenance of light fixtures.	Castle Wind Farm (Pty) Ltd	Operation and maintenance

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

OBJECTIVE 5: 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.

Project component/s	» Wind turbines
Potential Impact	» Increased noise levels at potentially sensitive receptors » Changing ambient sound levels could change the acceptable land use capability » Disturbing character of sound
Activity/risk source	» Wind turbines
Mitigation:	» Ensure that the change in ambient sound levels (measured in L_{Aeq})

Target/Objective	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; » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors

Mitigation: Action/control	**Responsibility**	**Timeframe**
Design and implement a noise monitoring programme. 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/s wind speed.	Castle Wind Farm (Pty) Ltd / Acoustical Consultant / Approved Noise Inspection Authority	Operation
If required, additional noise monitoring points at a complainant that registered a valid and reasonable noise complaint relating to the operation of the facility	Castle Wind Farm (Pty) Ltd / Acoustical Consultant / Approved Noise Inspection Authority	Operation

Performance Indicator	» Change in ambient sound levels (L_{Aeq}) as experienced by Potentially Sensitive Receptors is less than 5 dBA
Monitoring and Reporting	» Noise monitoring programme to be developed and implemented at the start of operation.

OBJECTIVE 6: 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.

Project component/s	» Wind energy turbines » Substation
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Generators and gearbox - turbines » Transformers and switchgear - substation » Fuel and oil storage

Mitigation: Target/Objective	» To comply with waste management legislation » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	Castle Wind Farm (Pty) Ltd	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Castle Wind Farm (Pty) Ltd	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.	Castle Wind Farm (Pty) Ltd	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.	Castle Wind Farm (Pty) Ltd	Operation and maintenance
Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor.	Castle Wind Farm (Pty) Ltd / waste management contractor	Operation
Used oils and chemicals: » Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	Castle Wind Farm (Pty) Ltd	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Castle Wind Farm (Pty) Ltd	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Castle Wind Farm (Pty) Ltd	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Castle Wind Farm (Pty) Ltd	Operation
No waste may be burned or buried on site.	Castle Wind Farm (Pty) Ltd	Operation

Performance	» No complaints received regarding waste on site or dumping.

Indicator	» Internal site audits identifying that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests. » No contamination of soil or water.
Monitoring and Reporting	» Waste collection must be monitored on a regular basis.· » Waste documentation must be completed and available for inspection on request. » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE 7: Maximise local employment and business opportunities during operation

Based on information provided by Castle Wind Farm (Pty) Ltd less than 10 permanent employment opportunities will be created during the operational phase of the project. The operational phase is expected to last for 20 years.

Project component/s	» Wind energy facility » 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. » 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	» Benefit to local tourism by providing the area with a potential additional tourist attraction. » In the medium- to long-term employ as many locals as possible to fill the full time employment opportunities.

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.	Castle Wind Farm (Pty) Ltd	Prior to commencement of operation
Develop training and skills transfer programme for local personnel.	Castle Wind Farm (Pty) Ltd	Prior to commencement

Mitigation: Action/control	Responsibility	Timeframe
		of operation

Performance Indicator	» Public exposure to the project. » Meeting with Local Municipality and local tourism organisations during the construction phase.
Monitoring and Reporting	» Indicators listed above must be met for the operational phase.

OBJECTIVE 8: Implement 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.

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 firefighting equipment on site. Apply for membership to local Fire Protection Association, should there be one in existance.	Castle Wind Farm (Pty) Ltd	Operation
Provide fire-fighting training to selected operation and maintenance staff.	Castle Wind Farm (Pty) Ltd	Operation
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	Castle Wind Farm (Pty) Ltd	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.	Castle Wind Farm (Pty) Ltd	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.	Castle Wind Farm (Pty) Ltd	Operation

Mitigation: Action/Control	Responsibility	Timeframe
Contact details of emergency services should be prominently displayed on site.	Castle Wind Farm (Pty) Ltd	Operation

Performance Indicator	» Firefighting equipment and training provided before the construction phase commences. » Appropriate fire breaks in place.
Monitoring and Reporting	» Castle Wind Farm (Pty) Ltd must monitor indicators listed above to ensure that they have been met.

OBJECTIVE 9: 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 additional 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.

Project Component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners. » Impact on farming activities on site.
Potential Impact	» Limited intrusion impact on surrounding land owners. » 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. » Operational activities on site could interfere with farming activities of landowner.
Mitigation: Target/Objective	» Effective management of the facility. » Mitigation of intrusion impacts on property owners. » Mitigation of impact on farming activities.

Mitigation: Action/Control	Responsibility	Timeframe
Effective management of the facility and accommodation facility to avoid any environmental	Castle Wind Farm (Pty) Ltd	Operation

Mitigation: Action/Control	Responsibility	Timeframe
pollution focusing on water, waste and sanitation infrastructure and services.		
Vehicle movement to and from the site should be minimised as far as possible.	Castle Wind Farm (Pty) Ltd & Employees	Operation
Local roads should be maintained to keep the road surface up to a reasonable standard.	Castle Wind Farm (Pty) Ltd	Operation
Limit the development of new access roads on site.	Castle Wind Farm (Pty) Ltd	Operation
Ensure on-going communication with the landowners of the site in order to ensure minimal impact on farming activities	Castle Wind Farm (Pty) Ltd	Operation

Performance Indicator	» No environmental pollution occurs (i.e. waste, water and sanitation). » No intrusion on private properties and on the activities undertaken on the surrounding properties. » Continuation of farming activities on site.
Monitoring and reporting	» Castle Wind Farm (Pty) Ltd should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met.

MANAGEMENT PLAN FOR WIND ENERGY FACILITY: DECOMMISSIONING CHAPTER 8

The turbine infrastructure which will be utilised for the proposed Wind Energy Facility is expected to have a lifespan of 25 to 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time. The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

8.1. Site Preparation

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

8.2 Disassemble and Remove Existing Components

The wind (turbine and tower sections) of the proposed facility will be disassembled once it reaches the end of its economic lifespan. A large crane would be required for disassembling the turbine and tower sections. Once disassembled, the 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.

8.2 Rehabilitation of the Site

In order to minimise the extent of rehabilitation activities required during the decommissioning phase, Castle Wind must ensure that constant effort is applied to rehabilitation activities throughout the construction, operation and maintenance phases of the project.

In decommissioning the facility, Castle Wind must ensure that:

- All sites not already vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
- Any fauna encountered during decommission should be removed to safety by a suitably qualified person,
- All structures, foundations and sealed areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
- All access/service roads not required to be retained by landowners are closed and fully rehabilitated.
- All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.
- All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
- All rehabilitated areas are monitored for erosion.
- Components of the facility are removed from the site and disposed of appropriately.
- Retrenchments should comply with South African Labour legislation of the day.

The section on Rehabilitation (Chapter 6) is also relevant to the decommissioning of sections of the proposed distribution line and must be adhered to.

REVISION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME CHAPTER 9

The EMPr is a dynamic document, which must be updated to include any additional specifications as and when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through survey by specialists of the development site. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features. In addition, the EMPr should be updated throughout the life of the facility in order to ensure that appropriate measure are included for the minimisation of impacts on the environment. Any amendments must be approved by the Competent Authority (i.e. DEA) prior to implementation, unless these are required to address an emergency situation.

APPENDIX A:

PLANT RESCUE AND PROTECTION AND REHABILITATION

METHODS FOR PLANT RESCUE AND HABITAT REHABILITATION

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.

Environmental Management Plan: an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

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: 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 EMPs mentioned.

The objective of the plan is therefore to provide:

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

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 EMP, 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:

» 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
» 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 time 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
» Viable goals of desired outcomes

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

» What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?
» A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation
» Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.

The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

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
  - Untransformed indigenous vegetation

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

» what will happen there
» what needs to be mitigated – including storm water- and erosion management
» which management units need priority intervention/mitigation
» how will this mitigation / intervention be done (method statements) including schedule of work
» realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation

» approximate timeframes
» monitoring protocol to evaluate success or failures of interventions
  - establish permanently marked transects and monitor with fixed-point photography
» who will be responsible for doing what
» how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

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

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

For drainage areas:

» First restore drainage line morphology following the guidelines of the Erosion management plan – without that ecological recovery cannot be initiated
» Determine if natural seed sources may be present further upstream
» If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
» Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) 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 should be monitored:
» Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
» Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
» Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
» Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting

- Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

8.8. Timeframes and duration

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

9. Conclusion

The Plant Rescue and Revegetation Management Plan is a document to assist the contractor, the developer, and the ECO 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

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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: » Turbines » Access roads and cabling between and to turbine units » Power line » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas) » Substation » All other infrastructure
Potential Impact	» Loss of suitable substrate for a stable vegetation cover » De-stabilisation and/or alteration of substrate and hence degradation of vegetation cover, significant change in species composition or loss of agricultural potential » Loss of suitable habitat for flora and fauna » 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 » Degradation and/or loss of riparian areas and wetlands on and beyond the project boundaries » A loss of indigenous vegetation cover and possibly endangered species » Disturbance of fauna species
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Existing IAPs as well as clearing thereof » Concentrated discharge of water from construction activity or new

	infrastructure » Storm water run-off from sealed, altered or bare surfaces » Mobile construction equipment movement on site » Cabling and access roads construction activities » Power line construction activities » River/stream/drainage line road crossings » Roadside drainage ditches » Project related infrastructure » Premature abandonment of follow-up monitoring and adaptive management of rehabilitation
Mitigation: Target/ Objective	» To minimise loss of plant species of conservation concern » To minimise unfavourable runoff conditions and loss of resources from the ecosystems » To minimise erosion of soil from site during and after construction » To minimise and mitigate unfavourable alteration to drainage lines, especially incision » To minimise damage to indigenous vegetation during and after construction » No accelerated overland flow related surface erosion as a result of project infrastructure » 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 » 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 » establish what interventions will be necessary relating to IAPs, soil erosion management, topsoil handling, landscape rehabilitation and revegetation » 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 » 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 » Genus as minimum, species if known » Habitat from which materials were collected	ECO	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
Indigenous plant materials for re-vegetation: » 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 » Indigenous materials shall only be removed from their habitat with the necessary permits whenever applicable » Each plant removed shall be handled, packed and stored in a manner suitable for that species » Removed plants shall be protected from windburn or other damage during transportation » No plants or plants with exposed roots shall be subjected to excessive exposure to drying winds and sun, or subjected to water logging » All plants shall be kept free from plant diseases and pests and protected from rodents or other damaging agents » All indigenous plants that have been removed prior to clearing shall be returned to conditions resembling their original habitat as close as practically possible	Contractor in collaboration with ECO	Before, during and after construction
Seed stocks for rehabilitation » Seed can be used for cultivation of desirable species for revegetation » Seed shall be utilised for direct sowing or hydroseeding » 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 » Seed harvested shall be insect- and pathogen free » Seed harvested shall not contain materials of any invasive species » Prior to clearing, seed should be collected from the site on a regular basis as species start to seed to maximise the amount of fully developed seed secured » From sites that will be cleared, 100% of all seeds available may be collected » 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 » On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for re-vegetation » 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 » Soil or other propagation media, were used, shall be weed- and pathogen free » Argentine ants shall be controlled at all times » The area where plants are stored shall be kept free of	Contractor, ECO to control	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
weeds » 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 » The nursery shall be adequately secured to prevent loss or theft of species		
Protected flora » 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 » 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 » These units will be considered as NO-GO areas during construction	Contractor and ECO	Before, during and immediately after construction
Invasives » Remove all invasive shrubs as per the Working for Water specifications	Contractor, ECO to control	Before, during and after construction
Mulch » 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 » 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 » preparation of mulch shall be done at source » mulched material shall be free of seed-bearing invasive plant material » the mulch shall be suitably stored – bagged if necessary - and will be used in rehabilitation and soil erosion management on the site » should additional mulch be used for rehabilitation, this should be obtained from invasive shrubs of areas not cleared » 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: » topsoils constitute the upper 20 – 30 cm of soil only, lower layers of soil are regarded as subsoil » 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 » care shall be taken during stockpiling to prevent the	Contractor, ECO to control	During and immediately after construction

Mitigation: Action/control	Responsibility	Timeframe
mixing of topsoil with subsoil and/or any other material » topsoils shall be stored in heaps no higher than 100 cm, and shall be re-applied as soon as possible » care shall be exercised during stockpiling of topsoils to prevent compaction thereof » topsoils shall be adequately protected from erosion by preventing concentration of surface water and scouring of slopes » erosion of topsoils has to be contained and repaired as soon as it occurs, before large scale erosion and loss of topsoil develops » 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 » 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 » where removed during clearing, should be stored separately and used in the rehabilitation program » boulders and rocks must be partially buried within the topsoil layer wherever practical to provide greater soil-holding stability and reduce water erosion » 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 » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm, » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » 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 » 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

Mitigation: Action/control	Responsibility	Timeframe
Application of topsoil » topsoils shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil » 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	Contractor, ECO to control	During and after construction
Soil stabilisation » mulch from brush shall be applied by hand to achieve a layer of uniform thickness » mulch shall be rotovated into the upper 10 cm layer of soil 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 » in very rocky areas a layer of mulch shall be applied prior to adding the topsoil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas o if mulch is limited, available mulch, together with harvested seeds, should be concentrated in these hollows to promote rapid re-vegetation in them » runnels or erosion channels developing shall be back-filled and restored to a proper condition o such measures shall be effected immediately before erosion develops at a large scale » 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 » 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 » upon completion of rehabilitation these reshaped and revegetated areas shall blend into the natural terrain	Contractor, ECO to control	After construction

Mitigation: Action/control	Responsibility	Timeframe
Revegetation		
Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » 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	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species ○ previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools » re-seeding shall occur at the recommended time to take advantage of the growing season » 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 » 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 » 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 » species to be planted include all rescued species » the size of planting holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil » soil around the roots of container plants shall not be disturbed » bulbous plants shall be planted in groups or as features in selected areas » before placement of larger plant specimens into prepared holes, the holes shall be watered if not sufficiently moist » during transplanting care shall be taken to limit or	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is

Mitigation: Action/control	Responsibility	Timeframe
prevent damage to roots » 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		reached
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil must be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from revegetated areas	Contractor	Before, during and after construction
Establishment » The establishment and new growth of revegetated and replanted species shall be closely monitored » 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 » Erosion shall be monitored at all times and measures taken as soon as detected » 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 » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications		

Performance Indicator	» No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as

	determined by ECO » 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 » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state 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 » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction » An incident reporting system must record non-conformances to the EMP. » 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 o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol

B. APPENDIX: CHECKLIST OF ACTIONS FOR REHABILITATION PLANNING

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

	» Obtain equipment, supplies and biotic resources as needed » Prepare an appropriate budget
Implementation tasks	» Mark boundaries and work areas » Install permanent monitoring fixtures » Implement restoration tasks
Post-implementation tasks	» Protect the rehabilitation site against initial disturbance, including herbivores » Perform post-implementation maintenance, especially continued monitoring and eradication of emerging IAPs » 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 » 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 B:

ALIEN INVASIVE MANAGEMENT PLAN

METHODS FOR ALIEN SPECIES REMOVAL

The sections below are taken from the Department of water Affairs: Working for Water Programme, whose guidelines and policies on alien plant species removal should be adhered to.

In general the use of herbicide by is strongly discouraged – unless for direct stump applications in areas at least 30 m from any type of wetland. This is due to the potential for herbicide and related compounds to be distributed into the wetland areas and thus damaging indigenous vegetation all along the watercourses and beyond.

Any control programme for alien vegetation must include the following 3 phases:

- Initial control: drastic reduction of existing population
- Follow-up control: control of seedlings, root suckers, and coppice growth
- Maintenance control: sustain low alien plant numbers with annual control

2.1. Mechanical Clearing

2.1.1. ADULT PLANTS AND SAPLINGS

2.1.1.1. Felling

Consider as first option where possible, but see section 3 regarding kill standing – although this is only mandatory in pristine or near-natural environments, kill standing may have to be considered where the tree to be felled on the project area is very large or tilted and by falling it could significantly damage the surrounding habitat or other structures.

Where trees are to be felled and removed, the stem/trunk shall be cut as close to the ground as possible but not higher than 150mm, using chainsaws, bow saws, brush cutters or cane knives. Where felling is to be followed by herbicide treatment the cut shall either be made by means of a saw, so as to produce a clean, flat and generally horizontal surface or in the case of suitably small, thin barked species, the stem shall be cut with a lopper. A slasher or kapmes should preferably not be used because of the diagonal cut that is produced. This minimises the herbicide absorption and the "sharp sticks" are a Health and Safety risk.

In the case of larger trees, they shall, where possible, be felled to fall uphill in order to reduce breakage and minimise the danger to workmen.

Felled material and other dead material (brush and logs) shall not be allowed to block or impede water courses and must be removed from all water courses, either 30 m away from the river or out of the flood line itself.

Felled material (thicker than 7 cm) shall be debranched and cross cut in manageable logs of not longer than 2,4 m or in lengths as directed and then stacked in windrows (brush lines) with the contour or moved to or from identified locations as directed by Project Management.

The logs and brush shall be stacked separately, at least 3 m apart. Windrows shall be with gaps of 2 m every 15 m and be as narrow as possible but not wider than 3 m. Where windrows are impractical heap stacking may be allowed after approval by the Project Manager. Heaps shall be spaced at a minimum distance of 20 m with a maximum ground cover of 16 m² in other words heaps of maximum 4 X 4 m.

Windrows must be a minimum of 10 meters away from any indigenous forest (10 or more closely spaced indigenous trees). On a slope nothing should be packed below the indigenous forest, because burning of the windrows will cause damaged to the indigenous forest by burning up into it.

2.1.1.2. Ring barking

Where ring barking is directed, the Contractor shall remove all bark (including the inner bark or phloem) from ground level to 50 cm up or such lesser distance as may be specified. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.

Bush knives or hatchets should be used for debarking. Herbicide can be applied to the exposed bark except in the case of Wattle spp. In the case of smaller trees and saplings with soft, thin skinned bark (especially *Acacia* and *Hakea* species.) the stem shall be beaten with the back of a hatchet and the bark peeled off.

2.1.1.3. Frilling

Where frilling is directed, the Contractor shall, at a height of approximately 50 cm, using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to affect the cuts around the entire stem and apply herbicide into the cuts.

2.1.1.4. Bark Stripping

Where bark stripping is specified all bark shall be stripped from the trunk between ground level and 1 m above ground level.

2.1.2. SEEDLINGS

2.1.2.1. Manual clearing

Where seedlings are relatively sparse, less than 1 m high and soil suitably soft or where specified in the Project Specification (where seedlings are growing in sensitive areas where chemicals cannot be used due to the risk of contamination or effect on adjacent plant populations or for any other reason), seedlings shall be removed by hand pulling which shall be so carried out as to ensure the removal of the roots. Hand pulled plants shall be left hanging on other vegetation or deposited in a pile to reduce the possibility of re-growth.

Where seedlings are dense or are too well established to be removed by hand and the Project Management has not directed hand pulling or herbicide treatment of the undisturbed plants, the seedlings shall be cut using a lopper or brush cutter (written approval must be obtained) and the stems then treated with herbicide.

It is anticipated that after initial clearing, every year there will be a multitude of seedlings of alien species emerging. Cleared sites will thus have to be constantly monitored, and as soon as a seedling can be identified as alien invasive species, these must be pulled out by hand.

2.2. Chemical Treatment

2.2.1. Foliar spray

(***Not recommended due to potential distribution of poison beyond target plants and thus killing of indigenous species***)

Where foliar spray has been specified, the spray shall be applied as to the leaves of the whole plant to the point of drip-off. Spraying shall not be done when the leaves are wet or in windy conditions. The herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label. Where the same herbicide is use for different methods e.g. foliar and cut-stump, different colour dyes must be used to identify the different herbicide mix ratios.

Spraying shall be done using a back-pack spraying system with a solid cone nozzle which allows for consistent, thorough application of the herbicide (e.g. Spraying systems TG 0,5 (or as indicated in the herbicide policy).

2.2.2. Cut-stump treatment

Where stumps are to be treated with herbicide the herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label, this shall be applied as soon as possible but not later than 15 minutes after felling, stripping or frilling. In the case of felled stumps all sawdust shall first be brushed off the cut surface.

A knapsack or handheld pressurised spray can, with a narrow angle solid cone nozzle or adjustable nozzle set to a solid spray, should be used. The pressure should be as low as possible to avoid the herbicide from bouncing off the sprayed surface and to minimise contamination; attention must be paid to achieving an even coverage only on the outer rim (Cambium area).

2.2.3. Basal bark application

(Only after written approval has been obtained, due to environmental damage caused by diesel)

Where directed and after written approval, herbicide shall be applied directly to the basal bark of trees. The herbicide shall be applied by knapsack sprayer as a coarse, low

pressure spray, using a narrow angle solid cone nozzle, all around the basal stem or trunk of the plant, from the ground up to the height as specified on the herbicide label, as well as to any exposed roots. The area to be treated shall be thoroughly wetted by the herbicide. Attention shall be paid to ensuring adequate application taking note of the condition and age of the bark.

In the case of multi-stemmed plants, each stem shall be treated.

2.3. Kill Standing vs. Felling

This section is to further explain the National Circular 18 of 2002 under the same heading.

As this National Circular contains a policy clause on the operational approach all WfW projects need to align their operations accordingly as a matter of urgency. The policy should be interpreted as follows (National policy in *Italic* font with interpretation in normal font):

All trees must be killed standing (i.e. NOT felled), except when the following applies: (where cut stump operations are underway on a property this will be allowed to be finished if negotiations for the property has already been concluded and written into the landowner's agreement, negotiations on new areas should thus be adapted accordingly as no further cut stump operations will be allowed except as indicated below):

- *Danger to lives & property and the tree must be removed* (it is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *All alien clearing within two tree lengths of roads, buildings, power lines etc* (fences should be added to the possibilities. It is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *Specific requirement of a partnership to fell* (this will be when the Programme and what it stands for will directly benefit from an operation other than frilling e.g. secondary industry operations, if this is not the case then the landowner must contribute to the price difference due to a change in the preferred operational method)
- *Where required to remove trees for specific flood-control measures* (no frilling should take place within the riparian zone that is the 1:20 year flood level or closer than 30 metres from the natural bank of a river. Trees in these areas should be removed.)
- *Where frilling is not a practical method due to tree growth form, treatment efficacy* (It is the responsibility of Project Management to assess this. If these exceptions

influence the workload then the person collecting the data for contract generation should be informed of such exceptions)

- *Where the frilling of trees increases the fire danger in the area* (where such a scenario is suspected Project Management should liaise with the landowner and also get the opinion of a reputable person, these findings should be recorded in writing and added to the landowner's agreement)

In most cases the resistance towards frilling are based on the aesthetics of the area after the operation. The most economical and effective method of eradicating invasive alien vegetation within the Programme's guidelines should remain the prime objective of efforts. It is the obligation and responsibility of people in all spheres of management to maximise the effect and efficiency of any eradication programme.

2.4. Species-specific clearing methods

Various herbicides have been registered for the control of alien invasive species. The first option though should always be felling the species as low as possible, followed by localised stump treatment and the remaining only as last-resort alternatives or where the alien is a vicious multi-stemmed scrambler, such as the bramble.

Chemicals do not only come at a cost, but will require proper storage, management, and handling. For operation details refer to the Working for Water Operational Standards spreadsheet provided separately.

Information for each invasive alien species as encountered on the project area, as well as alien invasive species that are highly likely to become established after initial clearing, is listed below.

OBJECTIVE: Optimise Operational Standards for Clearing of Invasive Alien Plants

The Contractor must take all reasonable measures to ensure the efficient use of manpower, operational equipment and chemicals for the systematic eradication of alien invasives on site.

Project component/s	Project components affecting the objective: » solar energy turbines » access roads » substation » power line
Potential Impact	» Hazards to landowners, workers and public » Security of materials » Substantially increased damage to adjacent sensitive vegetation and wetland areas
Activities/risk sources	» Operation of equipment » Use of herbicides » Use of fire » Distribution of regenerative material of invasive alien plants
Mitigation: Target/Objective	» To ensure effective systematic removal of invasive alien plants » To prevent additional spreading of invasive alien plants » To maintain low numbers and eventually eradicate unwanted species from the project area » To prevent any spillage of chemicals into the surrounding environment » To prevent and reverse damage to wetlands/pans caused by invasive alien plants » To protect members of the public/landowners/residents
Timeframe	» Training required: training schedule and training opportunities identified and started within three months of commencement of clearing

	» Initial control involving planning and drastic reduction of existing population: during site establishment and construction phase » Follow-up control: control of seedlings, root suckers and coppice growth: during construction and operational phase » Maintenance control: sustain low alien plant numbers with annual control: during operational and decommissioning phase	
Abbreviations	» Working for Water Programme (WfW) » Health and Safety (H&S)	
Responsibility	**RESPONSIBLE PERSON OR UNIT**	
	PROJECT MANAGER	PM
	CONTRACTOR/COMMUNITY WORKER	C
	ENVIRONMENTAL CONTROL OFFICER / COMMUNITY LIASION OFFICER	ECO
	TRAINING UNIT	TU
	PLANNING UNIT	PU

Mitigation: Action/control	**Responsibility**
1. PROJECT OPERATIONAL PLANNING	
1.1. Creation of detailed map of the area: Provides an overview of the project and it must indicate the following:	
• Project boundaries	PU
• Area/s where workers are sourced from	PM
• Other features relevant to project wetlands, invasive thickets, grazing areas, cultivated areas	PM, PU

Mitigation: Action/control	Responsibility
• Clearly indicate areas that need to be cleared and divide into different Management Units according to location and most prevalent invasive	PM, PU
1.2. Strategic plan and safety	
• Project Management to create an Area Strategic Plan / Method Statement for clearing alien invasive vegetation	ECO, PM
• Project Management to be familiar with the Area Strategic Plan	ECO, PM
• Evidence of Rules & Regulations given and explained to Contractor or Community Workers (this should include the Operating Standards)	PM, C
• Emerging and potential weeds reported through agreed communication lines, ecologist can be consulted for proper identification	PM
• A copy of the emergency plan and telephone numbers must be on site, workers must demonstrate knowledge thereof	PM
1.3. Management Unit Clearing Plan (MUCP)	
• It must be up to date	PU, PM
• A clearing strategy must be evident and supported by the planned priorities	PU, PM
• Project Managers must be able to show actual work done vs. planned work, supported by fixed point photographs	PM

2. TOOLS AND EQUIPMENT	
2.1. Hand tools in good condition and used correctly	
• Hand tools(e.g. lopper, pruning saw etc.) must be best suited to the work and the size of plants being cleared	PM, C
• The tools must have correct and properly secured handles and must be in safe working order	C
• A sharpening stone/file, with a hand grip, must be on site	C
• Gloves and goggles must be worn when sharpening tools	C
• The tools must be used in the correct manner; clearing must be done using the correct techniques	C, PM
• Safe working distances of at least two (2) tool-reach lengths apart must be maintained	C, PM
2.2. Chainsaws good condition and used correctly	
• Operators have received certified training in chainsaw operation, felling, cross-cutting and de-branching techniques and have been assessed for competence every six months. For training opportunities contact the regional WfW or otherwise qualified entity	PM, TU
• The chainsaws must be best suited to the clearing work and timber size	PM, C
• There must be a service maintenance schedule for all chainsaws Services (daily, weekly) are done and recorded	PM, C
• Safety and operational features must be in good order as per standard checklist	PM, C
• Chainsaw work is planned and executed for safe and efficient production	PM, C
• Correct felling / clearing techniques are applied	PM, C
• Correct cross-cutting and de-branching techniques are applied.	PM, C

• Correct re-fuelling procedures are followed to prevent spillages	C
• Chain sharpening is correctly done with the correct tools at each refueling	C
2.3. In-field fuel site	
• A cleared area, at least six (6) metres from rest areas, demarcated with hazard tape must be used to store fuel	C
• Fuel and oil containers at the in-field fuel site must be stored on an absorbent drip-mat or drip-tray	C
• A 2 kg dry chemical powder (DCP) fire extinguisher must be at least 3m distant from the fuel site and easily visible	C
3. STORES, WORKSHOPS AND OFFICES	
3.1. Stores, workshops and offices	
• Buildings and containers must be secure and provide safe storage space for equipment and/or supplies	PM
• The office / stores area must show a high standard of housekeeping (A place for everything, everything in its place)	PM
3.2. Herbicide stores	
• The building / container must meet the Herbicide Policy standards	PM
• A Material Safety Data Sheet and Label must be in the store for each stock category of herbicide stored. (Each product.)	PM
• Herbicides must be issued with reference to the WIMS contract number	PM
• There must be stock control of empty containers.	

• Empty containers must be stored until removal by a registered recycling company	ECO
• Excess, undiluted herbicide must be returned to the stores and noted on the stock sheet. Excess, diluted herbicide must be stored in a UV-resistant container and allocated to another treatment within 2 days or returned to a suitable container in the stores	ECO, C
• Burning of empty containers by Project staff or Contractor is prohibited	PM, C
3.3. Fuel and flammable liquids stores	
• The building / container must be suitable for the liquids stored in them	ECO
• Quantities limited to allowed maximum per class where proper storage facilities are not available:	
o Class I – 45L (petrol, thinners)	PM
o Class II – 270L (diesel, lube oils)	PM
• Proper housekeeping and handling procedures must be evident	PM
• Adequate measures to deal with spillage and contamination e.g. spill kit	PM
• Correct signage and fire-fighting equipment e.g. dry chemical powder fire extinguisher of at least 2.25kg	PM
3.4. Storage at contractor stores / houses: Where contractors cannot make use of proper dedicated stores, the following standards apply:	
• All equipment, supplies, herbicides, fuel and oils must be safely and securely stored with controlled access, in a suitable lockable building, container or a lockable trailer	C
• A 1kg dry chemical powder (DCP) fire extinguisher must be available outside the store / container	C

• PM to annually verify and keep record of inspection of compliance regarding storing facilities at contractors store / house	PM
4. HERBICIDES	
4.1. General	
• Workers must be specifically allocated and trained to work with herbicides and demonstrate knowledge of the risk of working with the selected chemicals and how to avoid that risk (NB: only employees with Pest Control Operator (PCO) certificates may administer herbicides and that such a team must work under direct supervision of a person with AVCASA registration in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947))	TU, PM
• Only registered herbicides as detailed in the WfW herbicide policy or on the product label may be used	PM
• A Material Safety Data Sheet (MSDS) and Label must be in the field for each product used	PM, C
• Written approval must be obtained via the approved communication channels from the National Office to use an unregistered herbicide for a particular specie or situation	PM, ECO
• Mix water must be clean & clear (not muddy)	C, PM
• Spray mix adjuvants (e.g. wetters, buffers etc.) must be used according to label instructions	PM, C
• In the absence of a built-in colourant a suitable dye must be used in applications	PM, C
• Contractors and applicators must demonstrate an understanding of why herbicide applications should not be done in unsuitable weather conditions; e.g. foliar application in windy conditions	C
• Quality check records must show that application methods are monitored for targeting, rates and spray drift	C, PM

• Where there is a risk of herbicide applicators entering water, knapsacks should be filled only half full	C, PM
• PM must submit a Herbicide-used sheet for every completed contract, information must be captured	PM, PU
• Herbicide applicators must demonstrate an understanding of spot spray patterns	C
• For cut-stump / frill / ring-barking, coverage must be even and spraying must be monitored to limit excessive run-off	C
4.2. Equipment	
• Equipment must be properly maintained according to regular scheduled services	C
• Equipment must not leak. Faulty equipment must be serviced or decommissioned	C
• Equipment appropriate to the application method and treatment must be used.	PM, C
• When using knapsack sprayers the following apply:	
o Knapsack sprayers must be fitted with pressure regulators set to the correct pressure (1bar / 100Kpa) or fitted with a constant flow valve	PM, C
o Knapsack sprayers must be fitted with the correct nozzle in good condition, appropriate for the application method used (e.g. TG1; FL5VS; TFVS2 or equivalent)	PM, C
• Lances must be secured to prevent damage when transporting.	C
• Washing of equipment must take place in a designated area, using the triple-rinse method	C
4.3. Safe storage and handling in-field	
• In a designated, shaded demarcated area	C
o Away from rest / eating areas	C

○ At least 20m from any water body	C
○ Away from crops, gardens etc.	C
○ Floor area covered suitable absorbent material	C
○ Bucket & spade must be available in case of spills	C
○ Clean water, washing bucket, soap & towel must be available for persons handling the herbicide & equipment	C
• Mixing containers must be UV resistant and leak proof	C
• Mixing containers must be clearly labeled, showing the brand name and concentration of the contents	C
• Refilling, mixing, washing and rinsing should only be done within the demarcated area	C
• Empty product containers must be triple-rinsed and punctured before it is returned to the store	C
• Rinsed water must be recycled for subsequent mixes	C
• Contractors must have proper records of daily herbicide mixtures and issues and actual herbicide use in the contracting teams on-site	C
5. SAFETY	
5.1. Hazard Identification and Risk Assessments (HIRA)	
• The HIRA process to be developed, recorded and available at the project / area and knowledge demonstrated by everyone.	PM,C
• Site Emergency Evacuation Plan must be drafted and communicated to all personnel.	PM,C
• Where relevant, hazards in the working area must be taped off. e.g. trenches, holes, hang-ups etc.	C

• The Written Safe Work Procedures Manual must be available, understood and adhered to by all working staff.	PM, C
5.2. First Aid kit	
• A first aid kit, fully stocked according to the standard stock list, must be easily accessible at all work sites, and regularly inspected by the PM.	PM, C
• All first aid treatment and usage of stock must be recorded in the dressing book kept on site / regional office.	C, PM
• The First Aid kit must be under control of a trained First Aider with a current valid certificate	C, PM
• There must be an alternative trained First Aider of opposite gender in the team	C
• A list of emergency numbers must be kept in the first aid box e.g. ambulance, doctor, hospital, fire brigade, poison info centre	C, PM
• A copy of the competency certificate of the first-aider must be kept on-site in the H&S file.	C, PM
5.3. Personal Protective Equipment and Clothing (PPE)	
• PPE must meet the minimum prescribed standards of quality (EU or SABS).	C, PM
• PPE must be replaced when it becomes ineffective through wear & tear.	C, PM
• PPE must be provided with due consideration to the hazard exposure as well as the PPE requirements as per occupation	C, PM
• A record must be kept of all PPE issued to contractors and workers, and signed for by them, with the acknowledgement to wear the PPE.	PM, C
• Project must conform to acceptable H&S Guidelines	PM, C

5.4. Substance abuse	
• The use of any mind altering substances is not allowed on-site (e.g. alcohol, dagga).	PM, C
• Persons in the WfW programme must demonstrate knowledge of the potential dangers and the workplace policy of drug use	ECO, PM, C
5.5. Extreme Weather Conditions	
• Demonstrate knowledge that no work in / near / on water bodies may take place during rain or lightning.	PM,C
• No felling or spray application of herbicides may take place during high wind conditions	PM,C
• The contractor should be informed of any adverse weather conditions	PM
6. METHOD OF WORK	
6.1. Appropriate clearing methods applied	
• A process of appropriate clearing method selection must be followed and recorded - use the species guide provided	PM
• Handling / processing of cleared material must be kept to a minimum, but due to a potential fire hazard and the allelopathic effect of leaf litter, cleared material must not be left on site. A specific area must be designated to stack and process material to make maximum use of wood for community members, whilst regenerative material must be destroyed by controlled burning.	PM, C
• A copy of the Treatment Methods table must be available in the Project Office	PM
• No frilling / ring barking is allowed within two (2) tree lengths of roads, fences, telephone and power lines, infrastructure (e.g. buildings) or in the **riparian zone of a river**	PM
6.2. Follow-up done timeously	

• An up-to-date follow-up plan must be used to ensure treatment is done on time	PM
• For foliar treatment there must be sufficient newly-growing foliage and plants must not exceed hip height	PM, C
• When follow-up operations are not done at the most cost-efficient stage, there must be specific reasons on record including cost/person day variations between planned and actual follow-up to be recorded	PM
6.3. Efficient team operation	
• Operational planning for the specific site must be evident. Different tasks must be coordinated in an efficient manner for optimum productivity. If possible, every management unit mapped should have its own team allocated.	PM, C
• Tool use and tasks must be in line with the site-specific requirements	C
• Daily or weekly production tasks must be set and actual production must be measured and recorded	C
6.4. Work methods conform to WfW standards	
• Record of inspection of method, quantity and quality according to the contract.	PM, C
• All invasive alien species treated within the contract boundaries	PM, C
7. ENVIRONMENTAL AWARENESS	
7.1. Site clean and free of litter and waste	
• There must be no litter from clearing activities on work sites, at any time and there must be a litter bag on site at the demarcated gathering area, cleared or removed daily and disposed of in an acceptable manner.	C

• Existing litter not cleared in light of possible health risks, that may be associated with certain waste, reported to PM and disposal solution with relevant authority found	PM, C
• Project Manager and contractors to demonstrate knowledge that soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site.	PM, C
• When loose waste material is transported on vehicles, it must be adequately tied down / covered and contained.	PM, C
7.2. Sanitation	
• As far as practically possible, provide formal sanitation (chemical or water-born). Where this is not possible, a spade and toilet paper must be easily accessible on every site.	C
• Human waste and used toilet paper must be buried at least 20 m distant from any watercourses or bodies and at least 50 cm deep.	C
• In sensitive areas (urban sites, wetlands) a portable toilet must be provided on site and the waste removed and disposed of in an acceptable manner.	C
• Clean water and soap must be provided and used for hand washing.	C
• The workers should be informed of personal hygiene and demonstrate its practice	C, PM
• Where relevant, sufficient toilets per gender need to be available	C, PM
7.3. Access routes	
• Existing access routes must be used. Where new access routes or paths are required, these must be planned and made in co-operation with the landowner / manager and marked with hazard tape	PM, C
7.4. Indigenous plants and animals	
• Indigenous plants should not be damaged where possible and animals must not be harmed.	C

• Alien trees with bird nests must be killed standing where possible. Site records must be kept.	PM, C
• Collection of plant parts of alien plants for medicinal or other purposes, may only take place with the appropriate permission. Collection records must be kept.	C
• Identify and protect indigenous plants and animals, especially:	
○ Red list data species (none recorded)	C
○ Protected plants (see species of conservation concern)	C
○ Sensitive communities (wetlands only, no other recorded on project area)	C
○ Wetlands	C
• No species of animal may be poached, snared, hunted, captured or willfully harmed, damaged or destroyed. Snares must be reported to land owners, PM or conservation authorities and removed immediately.	C
• Snakes and other reptiles that may be encountered on the treatment area must not be killed.	C
• Anthills and/or termite nests that occur must not be disturbed.	C
• Keep the relevant managers informed of dangerous or problem animals. Record sightings and encounters.	PM, C
• Keep food and rubbish out of reach of scavengers, e.g. apes and birds.	C
7.5. Invasive alien plant identification (IAP)	
• Alien invasive plants including aquatic alien plants must be identified, where required expert assistance must be used.	PM, C
• The relevant species to be removed must be pointed out to contractors and workers on site.	PM

• Damage to indigenous / desirable vegetation must be minimised.	C
7.6. Alien invasive dispersal	
• Where cleared material must be moved from the site, measures must be taken to prevent dispersal of reproductive material (e.g. seeds, cuttings).	PM, C
• Chipped plant material must be free of seed if used off-site (e.g. mulch).	PM, C
• Plants which have been removed must not be transported across or near to rivers or dams in which the species is absent.	PM, C
• Removed plants must not be stacked on top of indigenous flora.	PM, C
• Method and specifications chosen with due consideration of impact on the site, natural vegetation & regeneration.	PM
• Methods used must ensure that weeds are not distributed by the contractor and employees	PM, C
7.7. Site stabilisation / anti-erosion / rehabilitation measures	
• **Stack larger cut logs** along the contour and below knee height with 2 m gaps at 10 to 15 m intervals for access, escape, animal movement and to reduce run-off and soil movement where there is an enhanced erosion risk along stream banks or steeper slopes	PM, C
• Preserve indigenous plant cover and adapt treatment methods to allow indigenous plants to colonize the site.	PM, C
• Identify sites requiring additional stabilisation structures / measures / re-vegetation and obtain expert advice & planning to implement.	PM
• Take precautionary measures to protect stabilising plants (planted & natural) during follow-up spraying.	C

7.8. Site stabilisation / anti-erosion / rehabilitation records	
• Sites must be mapped and a unique Treatment Area number must be assigned. Comprehensive planting / maintenance records must be kept; including dates, species and number of plants and follow-up care.	PM
• A record of input costs must be kept, including: materials, plants, seeds, person-days etc.	PM
8. FIRE FIGHTING AND PROTECTION	
8.1. Fire Precautions on work sites	
• Smoking allowed in safe indicated areas, designated by the contractor / manager / landowner.	PM, C
• No fires are allowed on work sites.	PM, C
• Site specific reaction / evacuation rules must be applied in the case of wild fires.	C
• Basic appropriate fire-fighting equipment must be available at each work site; a minimum of five fire beaters and one filled knapsack fire-fighting pump, or alternative suitable equipment.	PM, C
• Where fuels and machines are used on site, a 2 kg dry chemical powder fire extinguisher in working condition must be available.	PM, C
• Fire Fighting & Extinguishing Equipment inspected and recorded.	PM
8.2. Fire Protection	
• The project must be a member of the Fire protection Association (FPA) and attend meetings where applicable	ECO, PM
• In FPA areas, the project must be on their communication network.	ECO, PM

• Fieldwork may not take place during red days or extreme danger rating days. (Contact Working on Fire office)	ECO, PM
9. TRAINING	
9.1. Induction	
• All new workers must receive orientation before starting work.	PM
9.2. Compulsory functional training	
• All training, including refresher courses, is compulsory.	TU, PM
• All training must be provided to workers and contractors within three months of commencement of work	TU, PM
• Project Managers must hold a valid training certificate, on file, for **all** the training courses required in their project. Alternatively, arrangement must be made with the WfW Programme or suitably qualified units to provide such training	PM
• Training must be in line with the latest WFW Training Policy	TU, PM
• Area / Project Managers must pass an Environmental Pest Control Course and apply for PCO Registration with the National Dept. Agric - Registrar.	TU
• Contractors - Limited Pest Control course.	TU
• Herbicide Applicators – WfW Herbicide Applicators course.	TU
• Other workers – Herbicide Awareness training.	TU
• Chain saw operators - chainsaw handling and maintenance, felling, cross-cutting and de-branching techniques.	TU

• Copies of all herbicide training certificates received and Pest Control Licenses must be available with the PM and contractor on-site.	PM, C
9.3. Training Plan & Profiles	
• The Training Annual Plan of Operations must be displayed.	PM
• The plan must be based on the WFW training matrix and policy.	TU, PM
9.4. Training Records	
• All training capture sheets, attendance registers, evaluation forms, and certificates must be filed in the Regional Training Manager's office or Area office.	TU, PM
• All Department of Labour monitoring sheets, correspondence, financial records and training schedules must be filed in the Regional Training Manager's office or Area office.	TU
9.5. Accreditation	
• All training must be aligned to unit standards, where possible.	TU
• All training must be provided by accredited training providers, where possible.	TU

Performance Indicator	» Project area is consistently cleared of invasive alien vegetation » Remnants of alien vegetation removed from where they were cleared to make way for the proposed development and rehabilitation of natural vegetation surrounding the development » No indication of further degradation and/or pollution of the areas surrounding the development » No members of staff/ public/ landowners injured
Monitoring	» Regular visual inspection of cleared areas for signs of resprouting, alien plant seedling emergence, new alien species invasions » An incident reporting system will be used to record non-conformances to the EMP.

	» Public complaints register must be developed and maintained on site. » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager. » ECO to address any infringements with responsible contractors as soon as these are recorded.

APPENDIX C:

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.
» 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. 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
» 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 been degraded already
» 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
» And any areas where developments cause water flow to accelerate on a soil surface.
» 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

7.1. 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
- 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 are begin 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 diary.
» All actions with regards to the incidents must be reported on 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 adapt or adjust to ensure the accelerated erosion is controlled.
» Monitoring must continue until the area has been stabilised

7.2. Stormwater Management

The ECO is responsible to monitor 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
» 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.
» Construction activity limited to specified areas. Stockpiles of aggregate and material will be positioned at least 50m 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 the rehabilitation weekly and record the findings in a site diary.
» All actions with regards to the incidents must be reported on 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.
» Monitor the erosion 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

In this section the equipment needed 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
» Tilling (roughing the surface)

6.1.2. Methods to prevent accelerated erosion

The following practises should 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 the 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 structures.

» 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.
  - 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.
  - 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
  - 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 (m^2/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 area

» 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 (e.g. grass species such as *Cynodon dactylon*, *Eragrostis curvula*) 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 m^2 (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 9to 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

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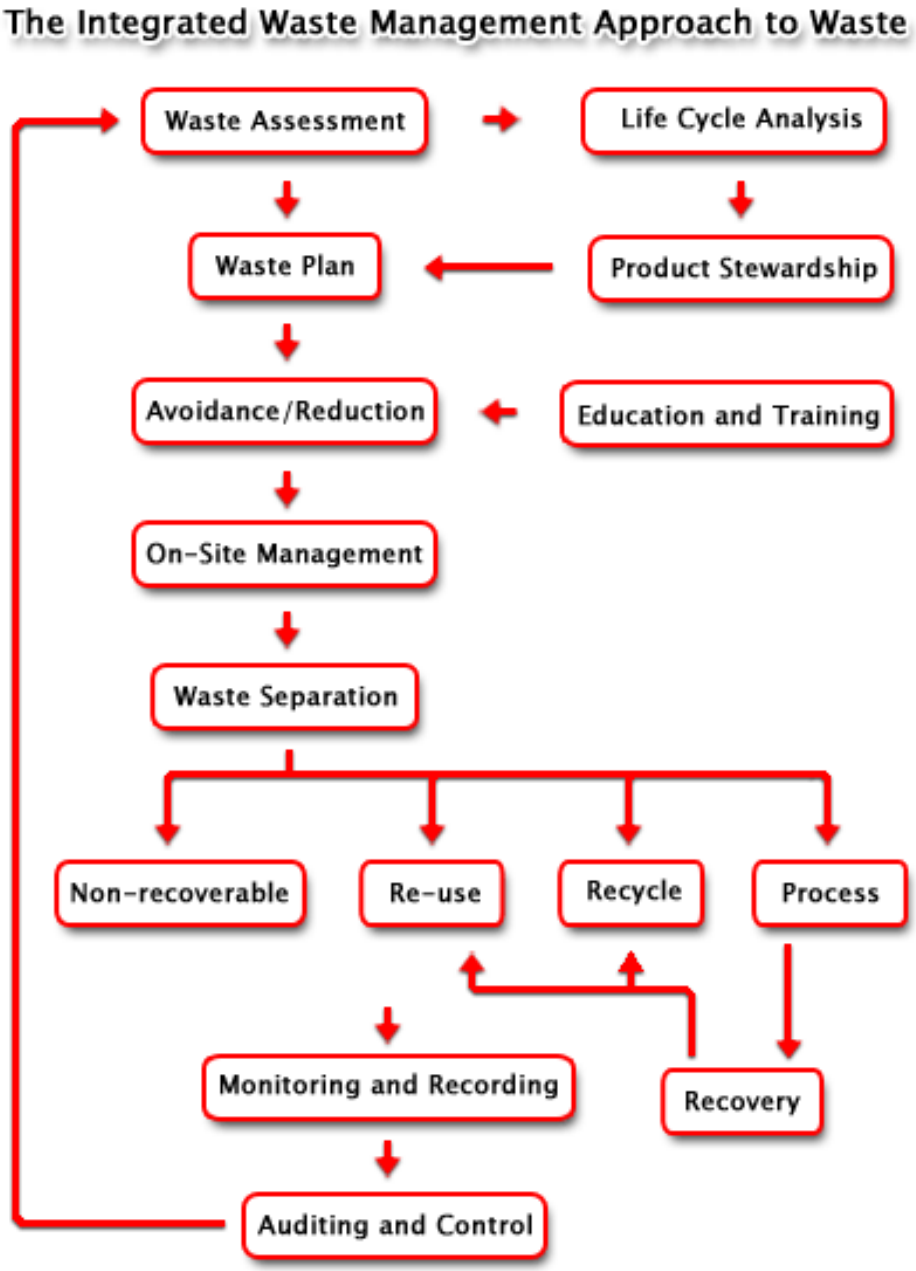
APPENDIX D:

CONSTRUCTION WASTE GUIDELINE

GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

Waste is broadly defined by the Department of Water Affairs in 1994 as: 'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity'. An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.



Source: http://www.enviroserv.co.za/pages/content.asp?SectionId=496

1. Waste Assessment

A detailed waste assessment is necessary to understand the waste types and volumes being produced. In order to achieve this, construction practices must be measured and analysed.

2. Waste Plan

A waste plan must be developed to provide appropriate solutions for managing the entire waste stream on site. The objective of the plan should be to reduce the volumes of waste to disposal and thereby to reduce the cost of management of the waste stream without compromising environmental standards. The plan should include recovery, re-use and recycle recommendations.

Construction Waste Management is the practice of reducing the actual waste that goes to the landfill site. Waste reduction is best met by recycling, and construction wastes offer several opportunities in this regard. In fact, 80% of the wastes found in construction waste piles are recyclable in some form or another. Wood, concrete, bricks, metals, glass and even paint offer several options for recycling.

There are three basic steps for construction waste management, i.e. Reduce, Reuse, and Recycle. **Reduce** is the prevention of the waste from arising and optimising material usage. Waste avoidance and waste reduction can be achieved through improved education and training - by improving efficiencies and by making staff environmentally aware.

Reuse is using existing materials instead of throwing these away. Reusing does not mean that it needs to be reused on the same construction site. Selling or donating waste materials to a third party is one option of construction waste management.

Recycle is somewhat limited since it only allows for those items that can be used on-site. The most important step for recycling of construction waste is on-site separation. Initially, this will take additional effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

3. What to Recycle

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

» Cardboard and Paper
» Wood

» Metals
» Plastics
» Glass
» Paints, Stains, Solvents and Sealants
» Oil

4. Materials Separation

Successful recycling requires good clean uniform collections of single waste types. This is most effectively achieved by separating the waste streams close to source rather than at the landfill site. Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

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

5. Recycling and Waste Minimisation Guidelines

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

» *Metals*
  * During construction, separate metals for recycling, including copper piping, wire, aluminium, iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.

» *Cardboard and Paper*
  * Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  * As far as possible, use recyclable packaging.
  * Separate cardboard waste, bundle, and store in a dry place.
  * Minimise the number of blueprints and reproductions necessary during the design and construction process.

» *Plastic*
  * Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  * As far as possible, use recyclable packaging.

Since more than 60 different types of plastic resins exist, the Plastics Federation of South Africa has adopted a voluntary number coding system for each category of plastics to aid in their sorting by material type for recycling (Bruyns et al, 2002). The most common resin types are itemised in Table 1.

Table 1: Identification System for Plastic

Id Number	Plastic Resin Type
1	PET (polyethylene terephthalate)
2	HDPE (high-density polyethylene)
3	PVC (polyvinyl chloride) or V (vinyl)
4	LDPE (low-density polyethylene)
5	PP (polypropylene)
6	PS (polystyrene)
7	Other (laminates, etc.)

» *Paints, Stains, Solvents and Sealants*
  * Unused materials should be taken to a hazardous waste collection facility.

6. On-site Management

Good supervision of the waste management programme on site is critical to success. Management of the entire on-site program is critical to ensure smooth operations.

7. Auditing and Control

The success of the waste plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Finally, good record keeping and control, becomes a continuous waste assessment process, allowing the waste plan to be improved and adjusted as required.

8. Useful contacts:

http://www.transpaco.co.za/page5.htm
Transpaco, a manufacturing and distribution company operating extensively in the plastics and packaging industries, conducts plastic reclamation and recycling.

http://www.jclenterprises.co.za/
JCL Enterprises for plastic sales of quality recycled plastic materials as well as the recycling of plastic.

http://www.rosefoundation.org.za/
The Rose Foundation specialises in the collection and recycling of used motor (engine) oil.

Information Sources:

http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines
http://www.enviroserv.co.za/pages/Content.asp?SectionID=587
http://www.enviroserv.co.za/pages/content.asp?SectionId=496
Programme for the Implementation of the National Waste Management Strategy. DEAT, May 2000
Residential Construction Waste Management Demonstration and Evaluation. Prepared for U.S. Environmental Protection Agency by NAHB Research Center, May 2, 1995

APPENDIX E:

GRIEVANCE MECHANISM FOR PUYBLIC COMPLAINTS AND ISSUES

GRIEVANCE MECHANISM / PROCESS

AIM

The aim of the grievance mechanism is to ensure that grievances / concerns raised by local landowners and or communities are addressed in a manner that is:

- Fair and equitable;
- Open and transparent;
- Accountable and efficient.

It should be noted that the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. However, the aim should be to address grievances in a manner that does not require a potentially costly and time consuming legal process.

Proposed generic grievance process

- Local landowners, communities and authorities will be informed in writing by the proponent (the renewable energy company) of the grievance mechanism and the process by which grievances can be brought to the attention of the proponent.
- A company representative will be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person will be provided to local landowners, communities and authorities.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
- The grievance will be registered with the contact person who, within 2 working days of receipt of the grievance, will contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting. Unless otherwise agreed, the meeting will be held within 2 weeks of receipt of the grievance.
- The contact person will draft a letter to be sent to the Complainant acknowledging receipt of the grievance, the name and contact details of Complainant, the nature of the grievance, the date that the grievance was raised, and the date and venue for the meeting.
- Prior to the meeting being held the contact person will contact the Complainant to discuss and agree on who should attend the meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the grievance mechanism process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

- The meeting will be chaired by the company representative appointed to address grievances. The proponent will provide a person to take minutes of and record the meeting/s. The costs associated with hiring venues will be covered by the proponent. The proponent will also cover travel costs incurred by the Complainant, specifically in the case of local, resource poor communities.
- Draft copies of the minutes will be made available to the Complainant and the proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of a dispute between the Complainant and the proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s will note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned;
- In the event that the parties agree to appoint a mediator, the proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the proponent, will identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator will be borne by the proponent. The proponent will provide a person to take minutes of and record the meeting/s.
- In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of the dispute not being resolved, the mediator will prepare a draft report that summaries the nature of the grievance and the dispute. The report should include a recommendation by the mediator on the proposed way forward with regard to the addressing the grievance.
- The draft report will be made available to the Complainant and the proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days.

The way forward will be informed by the recommendations of the mediator and the nature of the grievance. As indicated above, the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the proponent, either party may be of the opinion that legal action may be the most appropriate option.

APPENDIX F:

TRANSPORTATION MANAGEMENT PLAN

juwi Renewable Energies (Pty) Ltd

Castle Wind Energy Facility

Transportation Route Assessment

Prepared by: Athol Schwarz — Date: 20 Oct 2014.

Approvals

Hatch Goba

Approved by: Anita van Eeden — Date: 21 October 2014

juwi Renewable Energies (Pty) Ltd

Approved by: Charlotte Smith — Date:

Distribution List

Charlotte Smith

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Table of Contents

1. Introduction

juwi Renewable Energies (Pty) Ltd proposes developing a Wind Energy Facility and associated infrastructure, which shall be called Castle Wind Energy Facility.

The proposed Wind Energy Facility shall consist of no more than 31 wind turbines, each having a generating capacity of between 3,5 and 2,4 MW and is to be located approximately 28 km northeast of De Aar and 24 km southwest of Philipstown, on Portions 12 and 13 of Vendussie Kuil (Farm 165) within the Emthanjeni Local Municipality and Portion 1 of Knapdaar (Farm 8) within the Renosterberg Local Municipality, both of which are part of the Pixley ka Seme District Municipality of the Northern Cape Province of South Africa.

Hatch Goba (Pty) Ltd has been appointed to carry out a transportation route assessment for the large components of the wind turbines from various ports to the site.

2. Scope

The scope of this transportation route assessment for the large components (abnormal loads) of the wind turbines from the Port of Ngqura to the proposed Wind Energy Facility.

The scope of this report excludes all normal transportation required to the proposed Wind Energy Facility.

3. Purpose

The purpose of this transportation route assessment for the large components of the wind turbines from the Port of Ngqura to the proposed Wind Energy Facility is to identify any issues of potential significance to be investigated and assessed during the EIA phase.

4. Methodology

The identify and evaluate of the transportation routes from the Port of Ngqura to the proposed Wind Energy Facility, is limited to a ‘desk top study’.

Google Earth and various GPS software were used to identify the various transportation routes from the Port of Ngqura to the proposed Wind Energy Facility. Google Earth (street view) was used to identify the physical constraints and limitations along the paved routes within South Africa. Although every effort has been taken to identify the various physical constraints and limitations along the routes, this is only as accurate as the reference material used and the consultant cannot be held liable for the accuracy of the reference material.

As requested by the client, the limitations and constraints of the routes identified were not physically validated. The logistics company will have to validate the preferred route once appointed.

5. Exclusions

This transportation routes assessment does not address the access routes onto the proposed Wind Energy Facility nor the transportation routes to and from the proposed Wind Energy Facility by non abnormal vehicles.

6. Transportation Requirements

6.1 Legislative Framework

The National Road Traffic Act (Act 93 of 1996) and the National Road Traffic Regulations (2000), prescribe certain limitations on vehicle dimensions and axle and vehicle masses that a vehicle using a public road must comply with. However, certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass, as prescribed. Where such a vehicle or load cannot be dismantled, without disproportionate effort, expense or risk of damage into units that can travel or be transported legally, it is classified as an abnormal load and is allowed to travel on public roads under an exemption permit issued in terms of Section 81 of the National Road Traffic Act.

These Permits are normally issued by the Provincial Road Authorities and, if necessary, input is obtained from local and metropolitan authorities. Should such a permit be required, the client would need to obtain the necessary road permits from the relevant Road Authorities as it is outside of the scope of the EIA process.

6.2 Guideline Documentation

The Technical Recommendations for Highways (TRH 11 – Aug 2009) entitled “Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles” is the main guideline document.

In this document, various types of abnormalities and abnormal load and vehicle configurations are described. Abnormal load classification in terms of dimensions and mass is presented and routes are categorised in terms of paved width and posted speed limit. Dimensional and mass limitations for abnormal vehicles allowable under an exemption permit are defined. Marking and escorting requirements and speed restrictions applicable to abnormal vehicles are described. An overview of methods to estimate road pavement damage by abnormal vehicles is given.

A vehicle or a vehicle with its load that is considered to be indivisible, can be abnormal either in terms of dimension or mass or both.

6.2.1 Dimensional Limitations

The dimensions of an abnormal load may cause an obstruction and danger to other road users. For this reason, all loads must, as far as possible, conform to the dimensions requirements.

A vehicle / combination is dimensionally abnormal when any of the following dimensions exceeds the legal limitations:

- Length
- Width
- Height
- Overhangs

- Load projections
- Wheelbase

6.2.2 Load Limitations

The maximum load that an abnormal vehicle will be allowed to carry legally under permit on a public road is limited by:

- the capacity of the vehicle, as rated by the manufacturer;
- the load which may be carried by the tyres;
- the damaging effect on pavements;
- the structural capacity on bridges and culverts;
- the power of the prime mover(s);
- the load imposed by the driving axles and
- the load imposed by the steering axles.

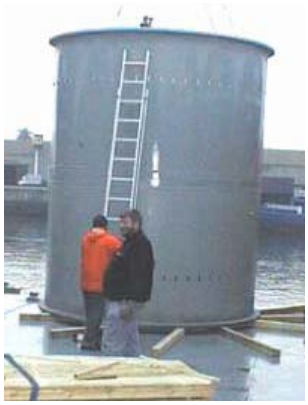
7. Wind Turbine Components

There are a number of wind turbine manufacturers worldwide. Each manufacturer has a variety of turbine models available on the market. Since the final selection of the turbine manufacturer and model will only be finalised later, the requirements and limitations on the transport routes, in terms of specific load weight and load height clearances, are based on Vestas V90 – 3.0 MW wind turbine (105 m high).

The dimensions and weights of the wind turbine components vary depending of the capacity and height of the wind turbine. As a worst case scenario, in terms of the size and number of turbine components that have to be transported to site, the information provided below is based on the Vestas V90, although this is not necessarily the wind turbine that is to be used on this project.

7.1 Foundation Insert

The foundation insert (varies depending on suppliers) is a steel element that is cast into the concrete foundation onto which the base section of the tower is fixed. The foundation insert has a diameter of 4,7 m and a length of 2,4 m. The weight of the foundation insert is in the order of 27,5 tons.



7.2 Tower sections

A 105 m tall tower normally consists of five sections. The lengths of these sections vary between 10 m (base) to 29,1 m (top). The base section has a maximum diameter in excess of 4 m and has a weight of 48 ton, while the top section has a minimum diameter of 2,3 m and has a weight of 33,5 ton. Each of these sections are transported separately on a suitable trailer.

7.3 Nacelle

The nacelle is fixed on top of the tower and houses the drive train. The weight of the nacelle, excluding the drive train, is in the order of 40 tons.

7.4 Drive Train

The drive train consists of the main shaft, the bearings, the gearbox and the generator. The components of the drive train weigh approximately 30 tons and are housed in the nacelle. To reduce the transportation weight, the drive train is installed in the nacelle on site.

7.5 Hub and Nose Cone

The hub is fixed to the drive train and the blades are fixed to the hub. Depending on the manufacturer, the hub and nose cone are either transported as a combined unit, or separately. The combined weight of the hub and nose cone is in the order of 25 tons.

7.6 Blades

These are the longest component and need to be transported on a specially transport trailer. The transport vehicle exceeds the dimensional limitations (length) of 22 m and will require a transportation permit.

7.7 Conclusion

Based on the information provided above, to deliver the components for a single wind turbine, from the Port of Ngqura to the proposed Wind Energy Facility, will require twelve individual trips.

Thus based on the assumption that 31 wind turbines are to be erected, a total of three hundred and seventy-two trips will be required. Not all of these trips will be classified as abnormal loads. However, this document does not address the transportation of any cranage that might be required for the off-loading or erection these components.

8. Castle Wind Energy Facility

The proposed Wind Energy Facility is to be located approximately 28 km northeast of De Aar and 24 km southwest of Philipstown, as shown on the Google image below. The only access to the national road network is via gravel roads onto the R389.

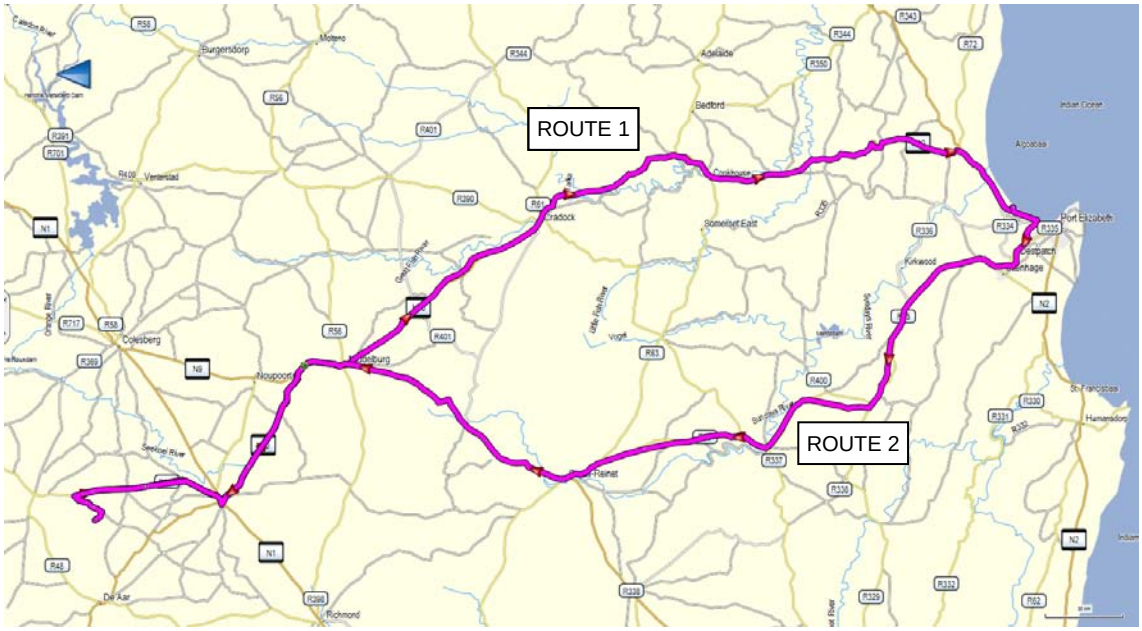
9. TRANSPORT ROUTE

9.1 Preamble

South Africa has an extensive road network, most of which is unpaved.

The closest port to the proposed Wind Energy Facility is the Port of Ngqura. Thus the wind turbine components are to be imported into South Africa via the Port of Ngqura and transported to the proposed Wind Energy Facility via road.

There are two routes from the Port of Ngqura to the proposed Wind Energy Facility, that are to be evaluated in this report. These two routes are shown in the image below:



The routes are as follows

- Route 1 – From the Port of Ngqura to the proposed Wind Energy Facility via the N10. The total distance is 491 km.
- Route 2 – From the Port of Ngqura to the proposed Wind Energy Facility via the R75. The total distance is 537 km.

The same route is followed from Middelburg to the proposed Wind Energy Facility.

These routes are subject to the limitations of the transportation permits and the transportation vehicles to be used by the logistics company appointed to transport the wind turbine components from the Port of Ngqura to the proposed Wind Energy Facility.

9.2 Route 1 - Port of Ngqura to Wind Energy Facility

Over the past number of months, the Port of Ngqura has seen an increase in activities due to the construction of the wind farms in the Eastern Cape.

The image below represents the route from the Port of Ngqura to the proposed Wind Energy Facility via the N10, and is described as follows;

- Exit Port of Ngqura, follow Neptune Road
- Turn Right onto N2 to Grahamstown, for long loads the south bound off-ramp is to be used (this implies that traffic travel against the normal flow of traffic until the vehicles can cross the median to get back onto the east bound carriageway), for other loads the normal on-ramp is to be used.
- At the N2 / N10 interchange continue on the N10 to Cradock
- Proceed on the N10 trough Cookhouse and Cradock
- R75 becomes R63

- Turn Right onto the N9 to Graaff-Reinet
- Proceed through Graaff-Reinet and Middelburg
- Turn Left onto N10 to Hanover
- Turn Right onto N1 to Colesberg
- Turn Left onto R389 to Philistowm
- Turn Left onto a gravel road to Burgerville
- Turn Right onto a gravel road and proceed to the site access

The total distance of this route is in the order of 491 km, of which 18 km is on gravel road.

A number of anomalies along this route were identified during the desk-top study, these anomalies would have to be further investigation by the relevant logistics company once appointed. The anomalies identified during the desk-top study, include inter alia;

- Under-passes (height and width constraints),
- Overhead cables (power, communication, etc)
- Intersections
- Bridges / culverts (load constraints)
- Passes
- Access through towns

9.3 Route 2 - Port of Ngqura to Wind Energy Facility

Over the past number of months, the Port of Ngqura has seen an increase in activities due to the construction of the wind farms in the Eastern Cape.

The image below represents the route from the Port of Ngqura to the proposed Wind Energy Facility via the R75, and is described as follows;

- Exit Port of Ngqura, follow Neptune Road
- Turn Left onto N2 to Port Elizabeth
- Turn Right onto the R75 at the N2 / R75 interchange to Uitenhage
- Proceed on the R75 through Jansenville,
- R75 becomes R63
- Turn Right onto the N9 to Graaff-Reinet
- Proceed through Graaff-Reinet and Middelburg
- Turn Left onto N10 to Hanover
- Turn Right onto N1 to Colesberg
- Turn Left onto R389 to Philistowm
- Turn Left onto a gravel road to Burgerville
- Turn Right onto a gravel road and proceed to the site access

The total distance of this route is in the order of 541 km, of which 18 km is on gravel road.

A number of anomalies along this route were identified during the desk-top study, these anomalies would have to be further investigation by the relevant logistics company once appointed. The anomalies identified during the desk-top study, include inter alia;

- Under-passes (height and width constraints),
- Overhead cables (power, communication, etc)
- Intersections
- Bridges / culverts (load constraints)
- Passes
- Access through towns

10. Route Evaluation

There are very little differences between the two routes up to Middelburg, there after the same route is followed to the proposed Wind Energy Facility. The selection of the final route is to be determined by the logistics company at the time of transportation.

11. Conclusion

Based on the information provided above, both routes are very much the same, there is no one route that is more advantages than the other, from the Port of Ngqura to the proposed Wind Energy Facility.

The final route selection will be subject to the limitations of the transportation permits and the transportation vehicles to be used by the logistics company appointed to transport the wind turbine components from the Port of Ngqura to the proposed Wind Energy Facility.

APPENDIX G:

OPERATIONAL BIRD MONITORING PROGRAMME

OPERATIONAL MONITORING METHODOLOGY OUTLINE

Introduction

Operational phase monitoring and research programs across North America and Europe have identified bats to be vulnerable to mortality due to wind turbines. Bats are particularly vulnerable to non-natural causes of mortality as they are long-lived animals with low reproductive fecundity. Additionally, there is relatively little scientific knowledge about bat populations and migration routes. It is recommended that a minimum of two year operational monitoring be undertaken as soon as turbines are functional, with auditing continuing throughout the lifespan of the Castle Wind Energy Facility.

The primary objectives of the operational phase monitoring programme are to:

- Determine the bat fatality rates for the Castle Wind Energy Facility;
- Determine the fatality rates for species of concern;
- Determine the fatality rates for migratory and resident bat species;
- Study the relation of bat fatalities within all habitats, geology and vegetation types found in turbine areas;
- Compare the bat fatality rates with those from wind farms in similar habitat types where possible;
- Determine the relationship between bat activity and bat fatality;
- Understand the relationship between bat fatality and weather conditions;
- Study the temporal distribution of bat fatalities across the night and seasons; and
- Determine whether mitigation measures are necessary to reduce bat fatality rates, and if necessary recommend detailed mitigation measures.

Methodology

Operational monitoring methodology is divided into two components, namely acoustic monitoring and carcass searches. On conclusion of the first year an adapted methodology will be outlined for the second year of monitoring.

Acoustic monitoring

Acoustics detectors and ultrasonic microphones will be used to monitor bat activity. They will be installed on the meteorological mast and/or a sub-sample of turbine nacelles to monitor activity in the rotor-swept path of high risk and select turbines.

Carcass searches

Carcass searches will be undertaken to determine bat fatality rates. This component of the methodology will be combined with that of the carcass searches for the bird monitoring programme.

Locals will be trained in proper search techniques to carry out the carcass searches and to record and collect all carcasses located. Searches will begin as early in the morning as possible to reduce carcass removal by scavengers. The order in which turbines are searched will ideally be randomly selected for each day to reduce carcass removal by predators from specific turbines before they can be searched. Search intervals will be a maximum of one week.

All necessary information will be recorded when a carcass is found. The carcass will then be bagged and labelled and kept refrigerated for species identification and to determine the cause of death by the specialist. Fatality monitoring will be carried out over all seasons of the year.

The necessary searcher efficiency and scavenger removal trials will be carried out at least once per season to calculate field bias and error estimation.

Wind turbine mitigation

Data collected throughout the monitoring programme will be used to inform and direct mitigation if the Castle Wind Energy Facility or specific turbines is found to be causing significant bat mortality. If mitigations are implemented, monitoring the effectiveness of the applied techniques will be necessary to evaluate and refine the success and economic efficiency of the mitigation.

Deliverables

- Four monitoring reports will be submitted annually for the first year, on conclusion of the first year an adapted reporting and methodology schedule will be outlined for the second year of monitoring. Reports will include descriptions of the field protocols and sampling methods. Raw data will be included in the reports as appendices, and methods for data analysis shall be transparent.
- A contingency plan will be compiled which informs immediate actions to be taken in the case of a significant mortality event, or if mitigation measures fail. A contingency plan will consist of additional mitigation measures to be implemented in the event that significant negative impacts are observed from a single mortality survey.
- An adaptive management approach to the operational monitoring programme.

The methodology of the assessment will comply with requirements pertaining to the South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (the latest version available at the time of commencement), which will be a mandatory requirement for all specialists.

APPENDIX H:

OPERATIONAL BIRD MONITORING PROGRAMME

POST CONSTRUCTION BIRD MONITORING FRAMEWORK

The bird monitoring work done to date on the Castle WEF site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However this is purely the 'before' baseline and aside from providing input into turbine micro-siting, it is not very informative until compared to post construction data. The following programme has therefore been developed to meet these needs. Post construction monitoring of live bird abundance and movement should be conducted for at least 1 year and carcass searches for at least 2 -3 years and repeated every 5 years thereafter.

1. During construction bird monitoring

It is envisaged that movement of ornithologists on site may be restricted for safety reasons during certain components of the construction process. The following is therefore a 'minimal input' programme designed to provide at least some insight into the reaction of key bird species to the construction activities on site:

- Focal site visits. These are probably the most important aspect of this phase of the programme, as they will provide insight into the effects of construction on for example the pair of Verreaux's Eagles near site. For this reason, the site should be visited at least twice during each breeding season (June to December) during which construction takes place, and ideally each season between now and construction.

These activities should comprise approximately two to three days on site twice per year, by the specialist alone.

2. Post construction monitoring

The intention with post construction bird monitoring is to repeat as closely as possible the methods and activities used to collect data pre-construction. One very important additional component needs to be added, namely mortality estimates through carcass searches. The following programme has therefore been developed to meet these needs, and should start as soon as possible after all turbines are turning (Note this should not wait until official commissioning of site).

Bird monitoring

The 12 walked transects of approximately kilometre each that have been done during pre-construction monitoring should be continued, as should the four vehicle based road count routes. The focal sites already established as well as any new focal sites identified by the 'during construction monitoring' should be monitored. All other incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) within the broader study area will be carefully plotted and documented. The four Vantage Points already established should be used to continue data collection post construction. The exact positioning of these may need to be refined based on the presence of new turbines and roads. A total of 12 hours of observation will be conducted at each vantage point on each site visit, resulting in a total of 24 hours direct observation on site per site visit. The activities at the control site should be continued, i.e. two Vantage Points, six Walked transects and two Vehicle Based transects.

It is estimated that the above activities will require 12 days on site by an observer team of 2 people, for four site visits in a 12 month period, including the control site.

Collision casualty surveys

This is a new component of the methodology. The area surrounding the base of all turbines should be searched up to a radius of 75% of the height of tip of blade above ground for collision victims. The frequency at which these searches need to be conducted is at least weekly for the first month of the programme and thereafter at a frequency determined by this initial work, but likely to be two weekly. Any suspected collision casualties should be comprehensively documented (for more detail see Jenkins *et al*, 2012). It is also important that associated infrastructure such as power lines and wind masts be searched for collision victims according to similar methods. It should be noted that the best practice guidelines on this aspect are currently under revision, and that the above detailed requirements may change by the time of the construction of this facility. The most up to date version of these guidelines available at the time should be adhered to at all times.

It is important that in addition to searching for carcasses under turbines, an estimate of the detection (the success rate that searchers achieve in finding carcasses) and scavenging rates (the rate at which carcasses are removed and hence not available for detection) is also obtained (Jenkins *et al*, 2012). Both of these aspects can be measured using a sample of carcasses of birds placed out in the field randomly. The rate at which these carcasses are detected as well as the rate at which they decay or are removed by scavengers should be measured. It is important that at least 20 carcasses are used, and that this is done twice in a 12 month period, in summer and in winter. Although it is important to try to use

carcasses similar in size and other factors to the target species for the site, this is unlikely to be achievable in practice. It is more likely that a readily obtainable species will be used, such as ducks or geese.

Since the mortality searches need to be done more frequently than the other monitoring), this may require a separate team with different skills and hopefully based closer to the site. This should be discussed with the specialist as soon as the project is confirmed as going ahead.

At this stage the time required for this component of monitoring is difficult to determine since it will also be dependent on the exact methods, i.e. dogs and other options. This should be discussed more with the developer as the time approaches.