MAINSTREAM RENEWABLE POWER

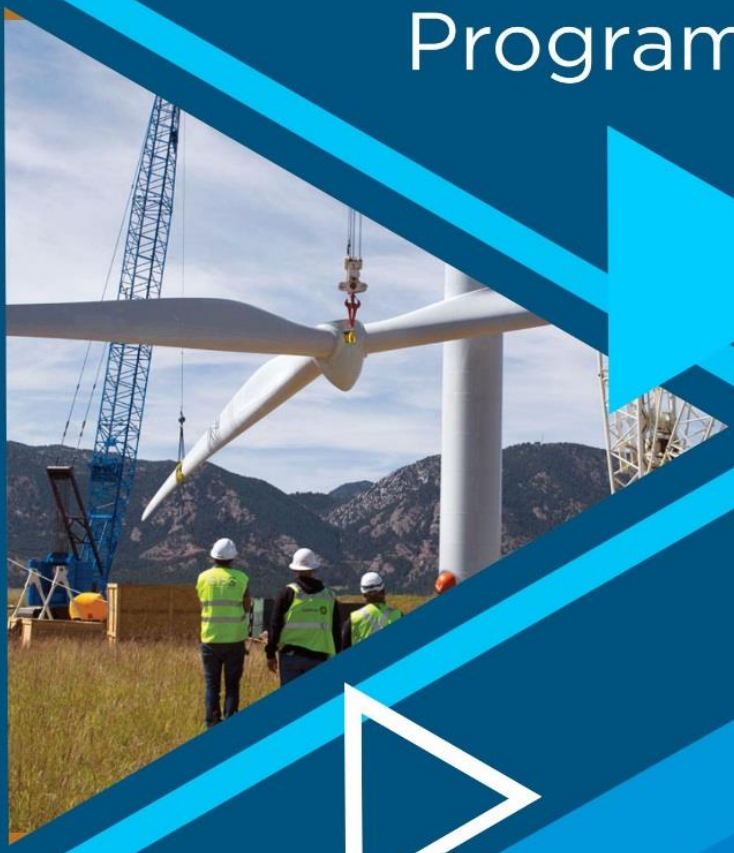
Amendment Report for the Application of a Substantive Amendment to the Environmental Authorisation issued for the development of the 140 MW Sutherland Wind Energy Facility, Sutherland, Northern and Western Cape Provinces

Sutherland

DRAFT AMENDMENT REPORT

APPENDIX D:

Environmental Management Programme (EMPr)



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1. Introduction

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as "Mainstream") received Environmental Authorisation, dated 22 February 2012, from the National Department of Environmental Affairs (DEA) to construct and operate the Sutherland Renewable Energy Facility (REF) with a collective generation capacity (wind and solar) of 747 MW (DEA Reference: 12/12/20/1782). On the 6 October 2015, DEA approved an amendment process to extend the validity of the Environmental Authorisation, the holder of the Environmental Authorisation, change in land portion names, exclusion of land portions, inclusion of listed activities and change in project name to extend the megawatt range from 747 to 1137 (DEA Reference: 12/12/20/1782/AM1).

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is currently applying for a substantive amendment to the Environmental Authorisation issued for the proposed Sutherland Wind Energy Facility (WEF) (12/12/20/1782/3/AM2).

Mainstream is proposing the following amendments to the EA:

Aspect to be amended	Previously assessed and authorised	Current proposed amendment
Hub height	**Up to 150 m**	**Up to 200 m**
Rotor diameter	**Up to 150 m**	**Up to 200 m**

In addition to the amendments to the turbine specifications noted above, Mainstream is also requesting an amendment to the contact details of the holder of the Environmental Authorisation

An Amendment report has been prepared will be submitted to the Department of Environment, Forestry and Fisheries (DEFF) (previously operating as the DEA for comment. An EMPr has been previously prepared and was approved under the second amendment application (12/12/20/1782/AM2).

This EMPr is still valid, and is hereby updated with the latest findings and recommendations from the specialist studies as part of this amendment process.

The following changes were made to the EMPr as part of this amendment process:

(1) The project team for the current amendment process is included in Table 2.
(2) The environmental sensitivity map has been updated (Figure 3)
(3) The project description is updated (Table 5)
(4) The tables in section 6 have been updated with additional mitigation measures provided by the specialists on the project team. The additional mitigation measures are indicated in yellow.
(5) Section 19 of the EMPr has been updated with the latest bird and bat monitoring guidelines
(6) CV of EAP has been updated in Appendix A
(7) The coordinates of the turbine positions are included in Appendix B.

2. Updated EMPr as part of this amendment application

This draft Environmental Management Programme (EMPr) is prepared for the Sutherland WEF as part of the requirements of the 2014 EIA Regulations promulgated under the National Environmental Management Act (NEMA, Act 107 of 1998).

The project team involved in preparing the EMPr that was approved as part of the Amendment 2 is listed in Table below. This team includes a number of specialists which have provided input throughout the original EIA process undertaken in 2011 for the proposed development of the Sutherland REF.

The project team involved in the current third amendment process is included in Table 2.

Table 1: The team consisting on Environmental Assessment Practitioners in a management role, and various specialists to provide technical expertise.

Name	Organisation	Role/ Specialist Study
Environmental Assessment Practitioner		
Surina Laurie	CSIR	Environmental Assessment Practitioner, Project Manager (Pr. Sci. Nat.)
Specialists		
Dr Dave Macdonald	Bergwind botanical surveys and tours	Botany
Simon Todd	Simon Todd consulting	Terrestrial ecology
Dr Andrew Jenkins	Avisense Consulting	Avifauna
Dr David Jacobs	UCT	Bats
Adrian Jongens	Jongens Keet and associates	Noise
Bernard Oberholzer Quinton Lawson	Bernard Oberholzer Landscape Architect MLB Architects	Visual
Dr Lita Webley David Halkett	ACO Associates	Heritage
Kerryn Mckune Desai	ERM Southern Africa	Socio-economic

Table 2: The team consisting of Environmental Assessment Practitioners in a management role, and various specialists to provide technical expertise.

SPECIALIST	CONSULTANCY	FIELD OF STUDY
Environmental Assessment Practitioner		
Minnelise Levendal	CSIR	Environmental Assessment Practitioner, Project Manager (Pr. Sci. Nat.)
Simon Bundy	ECOCOAST	Terrestrial Ecology
Chris van Rooyen & Albert Froneman	Chris van Rooyen Consulting	Avifauna (Birds)
Monika Moir & Stephanie Dippenaar	Stephanie Dippenaar Consulting*	Bats
Morne de Jager	Enviro Acoustic Research cc (EAR)	Noise
Quinton Lawson & Bernard Oberholzer	QARC BOLA	Visual
Dr Jayson Orton	ASHA Consulting	Heritage

Note: The initial Bat Impact Assessment was undertaken by David Jacobs (Specialist Reports on Bats – Proposed Renewable Facility at Sutherland (July 2010)) and Animalia Consultants (Pty) Ltd (Fifth and Final Progress Report of a 12-month Long-Term Bat Monitoring Study (January 2017)). Animalia are no longer undertaking Bat Assessments. Hence, Stephanie Dippenaar Consulting has been appointed to undertake the bat assessment for this amendment application.

3. Approach to preparing the EMPr

3.1 Compliance of this EMPr with the NEMA and EIA Regulations

This EMPr satisfies the requirements of Section 24N of the National Environmental Management Act (NEMA) (Act 107 of 1998) as well as Appendix 4 of the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (GN R982). An overview of where these requirements are met in this EMPr is presented in Table 1.

Table 1: Requirements of an EMPr as defined in terms of NEMA (Act 107 of 1998) and Appendix 4 of the 2014 EIA Regulations (GN R982).

Section 24N of the NEMA	Requirements for a EMPr in terms of Section 24N of the NEMA (Act 107 of 1998)	Location in this EMPr
(2) (a)	information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of- *(i)* planning and design; *(ii)* pre-construction and construction activities; *(iii)* the operation or undertaking of the activity in question; *(iv)* the rehabilitation of the environment; and *(v)* closure, if applicable;	Section 6
(2) (b)	details of- (i) the person who prepared the environmental management programme; and (ii) the expertise of that person to prepare an environmental management programme;	Section 2 and CV in Appendix A
(2) (c)	a detailed description of the aspects of the activity that are covered by the environmental management programme;	Section 6
(2) (d)	information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);	Section 3
(2) (e)	information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;	Section 6
(2) (f)	as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Section 6 Section 9 Section 10
(2) (g)	a description of the manner in which it intends to- (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; and	Section 6 Section 15 Section 16

	(iii) comply with any prescribed environmental management standards or practices.	
(3) (a)	set out time periods within which the measures contemplated in the environmental management programme must be implemented;	Section 6
(3) (b)	contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the prospecting area or mining area in question; and	N/A
(3) (c)	develop an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 6
Appendix 4 of the EIA Regulations	**Requirements for a EMPr in terms of Appendix 4 of the 2014 NEMA EIA Regulations (GN R982)**	**Location in this EMPr**
(1) (a)	Details of - (i) the EAP who prepared the EMPr; and (ii) the expertise of the EAP to prepare an EMPr, including a curriculum vitae;	Appendix A
(1) (b)	a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Section 6
(1) (c)	a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	Section 4
(1) (d)	a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Section 6
(1) (e)	a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	Section 6
(1) (f)	a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to – (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	Section 6
(1) (g)	the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 6
(1) (h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 6

(1) (i)	an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 6 Section 6
(1) (j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 6
(1) (k)	the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 6
(1) (l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 6
(1) (m)	an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 6
(1) (n)	any specific information that may be required by the competent authority.	N/A

3.2 Compliance to the requirements of the Environmental Authorisation

The EA, dated 22 February 2011, indicated in Condition 14 that certain plans must be included within the EMPr. The table below details the requirement as contained within the EA as well as a cross reference to where this is included within this EMPr.

Table 2: Content requirements of the EMPr as contained in the EA

Condition	Requirements for a the EMPr as per the conditions of the EA, 2011	Location in this EMPr
14.1	All recommendations and mitigation measures recorded in the EIR dated September 2011	Noted, this EMPr has been produced to include these measures
14.2	The requirements and conditions of this authorisation	Noted, this EMPr has been produced to include these measures
14.3	A plant and rescue plan	Section 8
14.4	An open space management plan	Section 10
14.5	A re-vegetation and rehabilitation plan	Section 9
14.6	An alien invasive management plan	Section 7
14.7	A stormwater management plan	Section 11
14.8	An effective monitoring system to detect any leakage or spillage of all hazardous substances	Section 14
14.9	An erosion management plan for monitoring and rehabilitating erosion events associated with this facility	Section 7
14.10	A transportation plan for the transportation of turbine components, main assembly cranes and other large pieces of equipment	Section 17
14.11	A traffic management plan	Section 18
14.12	An avifauna and bat monitoring programme	Section 19
14.13	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process	Figure 3
14.14	Measures to protect hydrological features	Section 6

3.3 Goals for environmental management

The overall goal for environmental management for the development of the supporting infrastructure to the Sutherland WEF is to construct and operate the project in a manner that achieves the goals presented in Figure 1.

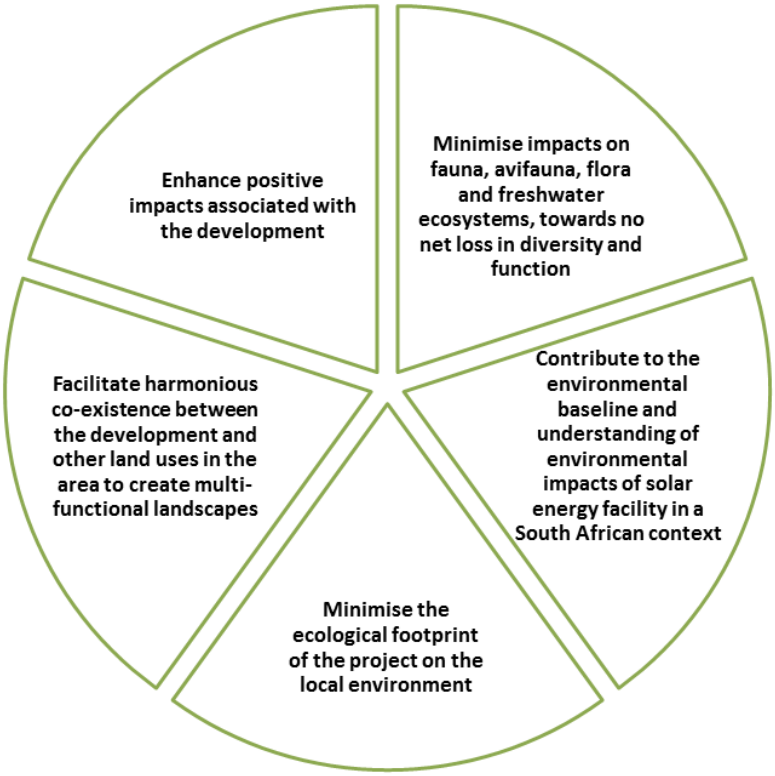

Figure 1: Environmental management goals for the proposed project.

3.4 Mitigation hierarchy

This EMPr strives to recommend avoidance, management, mitigation and monitoring actions towards enhancing positive impacts, and avoiding damage or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate potential impact. Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is described in Figure 2.

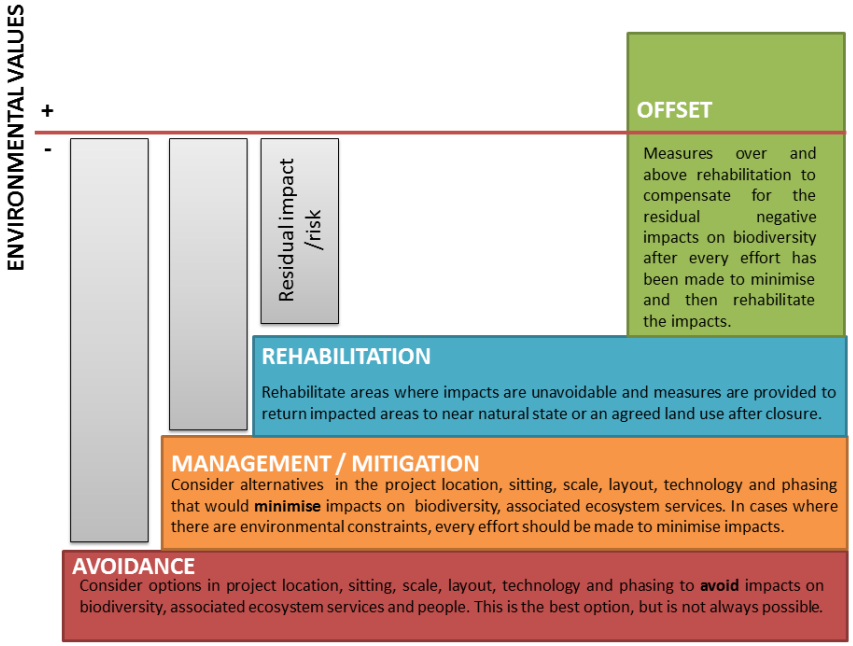

Figure 2: Mitigation hierarchy (after Rio Tinto, 2013).

3.5 Contents of the EMPr

Where applicable, this EMPr addresses the four phases of the project cycle: (1) Project Design phase; (2) Construction phase; (3) Operational phase; and (4) Decommissioning phase.

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

- **Impact**: The potential positive or negative impact of the development that needs to be enhanced, mitigated or eliminated;
- **Mitigation/Management action**: The actions needed to achieve the objectives of enhancing, mitigating or eliminating impacts;
- **Monitoring**: The key monitoring actions required to check whether the objectives are being achieved, taking into consideration methodology, frequency and responsibility.

3.6 Environmental sensitivities and preferred layout

Based on the studies outlined above and the findings thereof, an updated environmental sensitivity map has been produced

Figure 3) to show all the environmental features and their respective buffers (where applicable) that were identified by the various specialists. The map, in turn, was used to determine the buildable area of the WEF. The buildable area is the development envelope of the Sutherland WEF which determines the development constraints for the turbine placement.

The coordinates of the turbine positions for the Sutherland WEF are shown in Appendix 2.

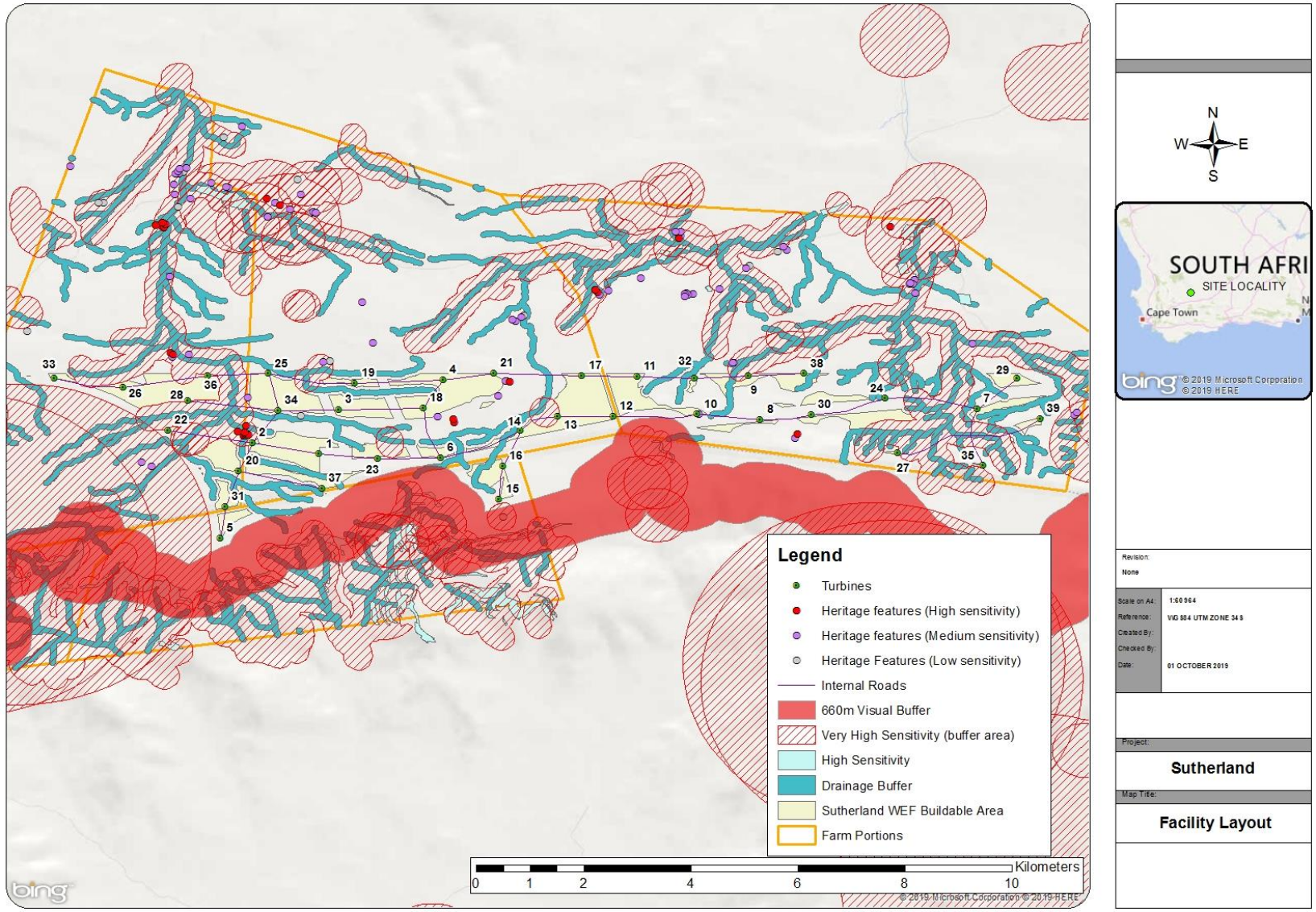

Figure 3: Updated Environmental Sensitivity map showing environmental features and their respective buffers (where applicable) that were identified by the various specialist studies overlain with the proposed buildable areas identified for the Sutherland WEF.

4. Roles and responsibilities

To achieve the goals set out in this EMPr there are responsibilities that need to be defined for the following key roles (Table 3):

- Project Developer;
- Environmental Control Officer (ECO); and
- Lead Contractor.

Table 3: Roles and responsibilities associated with the construction, operation and decommissioning of the proposed development of the supporting infrastructure in line with this EMPr.

Role	Responsibilities
Project Developer (Mainstream)	The Project Developer is the 'owner' of the project and, as such, has the following responsibilities: ➢ Be familiar with the recommendations and mitigation measures of this EMPr; ➢ Ensure that the conditions of the Environmental Authorisation issued in terms of NEMA are fully adhered to; ➢ Ensure that other necessary permits or licenses are obtained and complied with; ➢ Appoint the ECO and the Lead Contractor. It is proposed that Mainstream will implement the Self-Build Option for the supporting electrical infrastructure to be constructed. Following the construction phase, the supporting electrical infrastructure will either be transferred into the ownership of Eskom or otherwise remain in the ownership of Mainstream. This entails that should Eskom take ownership of the electrical infrastructure, the operational, maintenance and decommissioning requirements will be their responsibility.
ECO	Responsibilities of the ECO are to ➢ Oversee the implementation of the EMPr during the construction and operational phases, monitoring environmental impacts; ➢ Record-keeping and monitoring of compliance with conditions of the Environmental Authorisation; ➢ Ensure compliance to the plans included in the EMPr following approval of the Final EMPr. The lead contractor and sub-contractors may have their own ECOs, or designate ECO functions to certain personnel.
Contractor	The Contractor and its sub-constructors are responsible for overall execution of the activities envisioned in the construction phase, including implementation and compliance with the recommendations and conditions specified in this EMPr. Furthermore the Contractor's responsibilities are to: ➢ Ensure that all appointed contractors and sub-contractors are aware of this EMPr and their responsibilities in relation to the plan; ➢ Meet on-site with the Project Developer's ECO prior to the commencement of construction activities to confirm the construction procedure and designated activity zones; ➢ Ensure that each subcontractor employ an ECO (or have a designated ECO function) to monitor and report on the daily activities on-site during the construction period; ➢ Implement the overall construction programme, project delivery and quality control for the construction of the solar project; ➢ Oversee compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction; ➢ Promote total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and

Role	Responsibilities
	the environment; ➢ Ensure that safe, environmentally acceptable working methods and practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operational to be carried out safely; ➢ Ensure that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the EMPr, to the satisfaction of the Project Developer's ECO. ➢ Implement the Traffic, Transportation and Road Maintenance Management Plan set out in this EMPr (Section 10); ➢ Implement the Storm Water Management Plan set out in this EMPr (Section 11).

5. Project details

The project life-cycle activities can generally be divided into four phases (see below) and can be outlined as follows:

- Pre-construction;
- Construction;
- Operation (including maintenance and repair); and
- Decommissioning.

A description of each phase and the associated activities is provided below.

Pre-Construction

The layout may undergo minor adjustments based on geotechnical constraints onsite and input from pre-construction monitoring however any adjustments will be within the acceptable areas as defined by the EIA process.

Construction

The duration of the construction and commissioning phase of the project is estimated to be approximately 24 months to complete. Construction activities will include:

Site preparation, including subcontractor mobilisation, erection of fencing or suitable barriers, where required to protect sensitive habitat and archaeological sites, construction of site compound and lay down areas;

- Upgrading and construction of internal roads including laying of cables;
- Site clearance;
- Establishment of borrow pits;
- Laying of turbine foundations;
- Turbine delivery and installation
- Completion of internal electrical connections;
- Turbine function testing to verify proper operation of the facility; and
- Commissioning.

Operation

Once the WEF construction is completed and it becomes operational, it is expected that the facility will have a minimum life span of 20 years. Regular maintenance will be required to ensure the turbines are kept in optimal working order. The wind turbines will operate at all times provided wind speeds are suitable with the exception of downtime required for maintenance activities. For the most part, day to day facility operations will be done remotely through the use of computer networks. The WEF can operate in parallel with daily farming activities due to the relatively small footprint of the turbines.

Decommissioning

Once the facility has reached the end of its life cycle, the turbines and PV array may be refurbished or replaced and continue operating as a power generating facility or the facility will be closed and decommissioned. If decommissioned all components, excluding turbine foundations and some roads, of the renewable energy facility will be removed and the site will be rehabilitated. The concrete pedestals of the turbine foundations will be cut down and concrete removed to below finished ground level and covered with topsoil. Some roads will be removed, covered with soil and replanted to allow for a return to agricultural landuse (cultivation and grazing).

The components proposed to form part of the WEF are detailed in Table 5 below.

Table 4: Revised Project details for the proposed Sutherland WEF.

	General	
Closest town:	Sutherland	
Local Municipality:	Karoo Hoogland and Laingsburg Local Municipalities	
District Municipality:	Namakwa District Municipality	
Province:	Northern Cape and Western Cape	
	Project specific information	
Farm portions:	• Portion 1 of Beeren Valley Farm 150; • Remaining Extent of Beeren Valley Farm 150; • Portion 1 of Boschmanskloof Farm 9; • Portion 1 of Botmanshoek Farm 10; • Remaining Extent of Botmanshoek Farm 10; • Portion 1 of Schietfontein Farm 179; and • Remaining Extent of Nooitgedacht Farm 148	
Proposed infrastructure	**Component**	**Description /demission**
	Wind turbine generators	39 wind turbines 140 MW Height of up to 200 m and rotor diameter of up to 200 m (as part of the current amendment proposal)
	Internal and external electrical connections	The wind turbines will be connected to another by means of medium voltage cables. The cables will be buried approximately 1m below ground level
	Access roads	• An internal gravel road network will be constructed to facilitate movement between turbines on site. • Roads will be 15 m wide including drainage and cabling and 4 km in length. • Some existing public roads may need to be upgraded to facilitate the turbine transport.
	Additional infrastructure (includes a laydown area, a temporary site compound area for contractors and a borrow pit)	• A hard standing laydown area of a maximum of 10,000m^2 will be constructed. • A site compound will be constructed for all contractors, this would be approximately 5 000m^2 in size. • A number of borrow pits may be distributed around the site. These will be backfilled as far as possible once construction is complete.

6. EMPr for the proposed Sutherland WEF

6.1 Project planning and design

Aspect	Objective	Action	Frequency	Responsible Party
6.1.1 Heritage Resources				
Damage or Destruction of Cultural Heritage Interests	➢ Manage the potential impact to heritage resource	• Avoid disturbance or damage to buildings and structures older than 60 years by maintaining 500m buffers around the on-site dwellings. • Avoid inland water bodies (100m buffer) and rivers (200m buffer). • Maintain a 200m buffer zone around cemeteries or graves onsite. • Maintain a 500m buffer around the onsite dwellings. • A Heritage Walk-Down of all proposed locations of wind turbines, roads and all associated infrastructure not surveyed in the 2011 HIA must be completed prior to construction. • The Heritage Walk-Down must be conducted by a qualified archaeologist and palaeontologist and a report detailing the results of the survey, including an assessment of impacts on identified heritage resources must be submitted to SAHRA for comment prior to construction. No construction may commence without comments from SAHRA; • All identified heritage resources must be avoided with a 30 m buffer zone; • A Conservation Management Plan (CMP) must be developed for heritage resources that are to be conserved in-situ. The CMP must be submitted to SAHRA for comment; • Should it not be possible to retain heritage resources in-situ, relevant permits in terms of section 34, 35 and/or 36 must be applied for mitigation measures to be conducted after the walk-down has been completed. These permits must be applied for by a qualified archaeologist or palaeontologist depending on the heritage resources that require mitigation. No permits may be issued without the above requested walk-down report.	Once-off	❖ Project Developer

6.1.2 Terrestrial Ecology				
Destruction of natural vegetation	➢ Avoid the loss of Plant Species of Special Concern.	• The turbines should not be sited at points below the 1 600 m amsl.	Once-Off	❖ Project Developer
6.1.3 Avifauna				
Bird Habitat Loss Destruction, Disturbance and Displacement	➢ Minimise impacts on birds	• The number of turbines needs to be reduced from the authorised 56 to a maximum of 39 turbines to reduce the collision risk for raptors; and • The 500 m turbine-free buffer zone along the edge of the escarpment should be increased to a minimum of 660 m. • A precautionary 3 km turbine-free buffer zone must be implemented around each of the two Verreaux's Eagle nests located at 32°39'50.76"S, 20°51'16.02"E and 32°39'43.41"S, 20°51'49.07"E.	Once-off	❖ Project Developer
6.1.4 Bats				
Bat fatalities due to collision or barotrauma	➢ Minimise impact to bats	• Adhere to the bat sensitivity map as indicated in Section 4.2.2 of the bat specialist report for this amendment (Moir & Dippenaar, 2019 in Appendix C of the amendment report) and avoid development in the demarcated high sensitivity areas and buffers. Medium sensitivity areas and buffers should preferably be avoided, but would there be turbine components in these areas, mitigation will have to be applied and curtailment need to be put into place from the onset of the wind farm, as described in Section 7 of the final EIA report (ERM, 2011), also see Section 4.5.4 and Table 8 of the draft amendment report. • A maximum amount of 39 turbines, with a hub height of 200 m and a rotor diameter of 200 m, is proposed within the provided total output of 140 MW. If more than 39 turbines with these specifications are installed, then mitigations as described in Table 8 of the amendment	Once-off	❖ Project Developer

		report will be applicable. Should smaller turbines be deployed, more turbines may be installed, but with agreement of a bat specialist.		
6.1.5 Freshwater ecology				
Destruction of freshwater resources	➢ Avoid loss of the integrity of freshwater features	• Sensitivity maps have been developed for the study area, indicating the freshwater environments, their relevant buffer zones and regulatory zones in accordance with the National Environmental Management Act (Act 107 of 1998). It is recommended that these sensitivity maps be considered during all phases of the development and with special mention of the planning of infrastructure layout, to aid in the conservation of the freshwater habitats and environmental resources within the study area; • The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas; • Planning of temporary roads and access routes should take the site All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel	Once-off	❖ Project Developer
6.1.6 Visual Resources				
Visual impact	➢ Minimise visual intrusion	• A visual buffer zone of 500m for the wind turbines from farmsteads and other rural dwellings will be established. Note: It is recommended by the visual specialist in the current amendment application that the original escarpment visual buffer of 500 m for the turbines should be proportionally increased to 660 m. • A visual buffer of 250m for the wind turbines from the local district roads and external farm boundaries will be established. • A visual buffer zone of 500m for the wind turbines along the main drainage courses.	Once-off	❖ Project Developer ❖ Contractor

		• A 250m setback or the wind turbines from farm boundaries should be observed. • Cables to be located underground as far as possible. • The substation and O&M buildings to be grouped together as far as possible to minimise the scatter of buildings across the site. • The design of the buildings to be compatible in scale and form with buildings of the surrounding rural area, and with the regional architecture. • All yards and storage areas to be enclosed by masonry walls.		
6.1.7 Socio-economic				
Socio-Economic Impact: Community Development	➢ Enhance benefits associated with the Community Development Trust	• Mainstream SA should continue, as is their stated intention, to explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts. At this preliminary stage, and in accordance with the relevant BEE legislation and guidelines, up to four percent of after tax profit could be used for community development over and above that associated with expenditure injections into the area.	Once-off	❖ Project Developer
Economic Impact: Employment and Procurement	Ensure that employment of local people is maximised and procurement of local, regional and national services is maximised:	• Mainstream SA will establish a recruitment and procurement policy which sets reasonable targets for the employment of South African and local residents /suppliers (originating from the local municipality) and promote the employment women as a means of ensuring that gender equality is attained. Criteria will be set for prioritising, where possible, local (local municipal) residents/suppliers over regional or national people/suppliers. All contractors will be required to recruit and procure in terms of Mainstream SA's recruitment and procurement policy. • Mainstream SA will work closely with relevant local authorities, community representatives and organisations to ensure that the use of local labour and procurement is maximised. • Mainstream SA to work closely with the wind turbine suppliers to provide the requisite training to the workers. The training provided will focus of development of local skills. • Ensure that the appointed project contractors and suppliers have access to Health, Safety, Environmental and Quality training as required by the project. This will help to ensure that they have future	Once-off	❖ Project Developer

		opportunities to provide services to the sector.		
6.1.8 Soils and agricultural potential				
Agricultural land	Minimise disruption to agricultural activities and loss of agricultural land.	• All workers will agree to the Code of Conduct and be aware that contravention of the Code could lead to dismissal • All directly affected and neighbouring farmers will be able to lodge grievances with Mainstream SA using the Grievance Procedure.	On-going	❖ Project Developer

6.2 Construction phase

Aspect	Objective	Action	Frequency	Responsible Party
6.4.1 General compliance				
Compliance with EMP	➢ Confirm Mainstream SA and appointed contractors commitment to adherence to EMP.	• Ensure that the EMP is available at the site during installation. • Ensure that equipment is in place to meet EMP requirements. • Signed commitment from subcontractors to compliance with EMP. • Sentech prior written consent must first be obtained before any construction activities underneath, along, across or within close proximity to Sentech infrastructure can begin and shall comply with applicable Sentech guidelines relating to clearance between equipment and the proposed construction activity. Furthermore, the applicant shall clearly adhere to, and ensure all installations shall be fully compliant with the Occupational Health and Safety Act Bo. 85 of 1993. • The contractor shall, in carrying out any work or project, take all the necessary precautions for the safety of Sentech's employees, contractors, representatives and its property, including the radio transmitters and links on or near the site against damages as a result of construction of the applicant's energy project.	On-going	❖ Contractor ❖ ECO
6.4.2 Heritage Resources				
Damage or Destruction of Cultural Heritage Interests	➢ Minimise damage to cultural heritage interests	• Before any major construction commences a thorough field survey of representative natural and artificial rock exposures	On-going	❖ Contractor ❖ Appointed archaeologist

Aspect	Objective	Action	Frequency	Responsible Party
		within the study region should be undertaken by a qualified palaeontologist. • Buffer zones around built structures should be maintained during the construction phase to prevent damage to structures of cultural heritage interest. • Mitigation of the pre-colonial, colonial archaeology and avoidance of marked graves which may not have been identified during the site survey should involve micro-siting prior to construction. • Should any human burials, archaeological or palaeontological materials (fossils, bones, artefacts etc.) be uncovered or exposed during earthworks or excavations, they must immediately be reported to the HWC and SAHRA. • If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils (e.g. trace fossils or stromatolites) or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/John Gribble 021 462 5402) must be alerted. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Itumeleng Masiteng/Mimi Seetelo 012 320 8490), must be alerted immediately. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the findings at the expense of the developer. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required at the expense of the developer.		❖ ECO
6.4.3 Avifauna				
Bird Habitat Loss Destruction, Disturbance and Displacement	➢ Minimise impacts on birds	• Habitat loss and disturbance can be mitigated during the construction phase by on-site demarcation of 'no-go' areas. These areas should be identified during pre-construction monitoring	On-going	❖ Contractor ❖ Appointed ornithologist ❖ ECO

Aspect	Objective	Action	Frequency	Responsible Party
		• Monitoring must be undertaken (See Section 18)		
Loss of priority bird species	➢ Avoid or minimise impacts to priority bird species	• A 3 km turbine-free buffer zone must be implemented around each of the two Verreaux's Eagle nests located at 32°39'50.76"S, 20°51'16.02"E and 32°39'43.41"S, 20°51'49.07"E. • A walk-through by the appointed avifauna specialist prior to the construction commencing, to confirm the location and status of all priority species nests within the area of influence of the wind farm	Ongoing	❖ Contractor ❖ ECO ❖ Appointed ornithologist
6.4.4 Bats				
Impact to bats	➢ Minimise bat collisions and impacts to bats	• Adhere to the bat sensitivity map as indicated in Section 4.2.2 of the bat specialist report for this amendment (Moir & Dippenaar, 2019 in Appendix C of the amendment report) and avoid development in the demarcated high sensitivity areas and buffers. Medium sensitivity areas and buffers should preferably be avoided, but would there be turbine components in these areas, mitigation will have to be applied and curtailment need to be put into place from the onset of the wind farm, as described in Section 7 of the final EIA report (ERM, 2011), also see Section 4.5.4 and Table 8 of the draft amendment report. • A maximum amount of 39 turbines, with a hub height of 200 m and a rotor diameter of 200 m, is proposed within the provided total output of 140 MW. If more than 39 turbines with these specifications are installed, then mitigations as described in Table 8 of the amendment report will be applicable. Should smaller turbines be deployed, more turbines may be installed, but with agreement of a bat specialist. • Install bat detectors at height as advised by the post construction bat specialist, preferably at hub height at the appropriate turbines, with the deployment of the turbines; and • A bat specialist walk through, as deemed necessary by the specialist, prior to construction, is proposed to confirm avoidance of priority species roost sites and appropriate buffer	Prior to construction	❖ Contractor ❖ ECO ❖ Appointed ornithologist

Aspect	Objective	Action	Frequency	Responsible Party
		areas.		
6.4.5 Fauna & Flora				
Vegetation loss and impact to fauna	➢ Prevent unnecessary disturbance and damage to natural vegetation and topsoil loss.	• Subcontractors are to use existing roads and tracks as far as possible. • Topsoil must be set aside to facilitate re-vegetation. • Construction vehicles must stick to the designated and prepared roads. • No vegetation should be collected for fire wood. • During construction in areas classified as high sensitivity areas, a botanist or ecologist will be consulted to ensure micro-siting of turbines minimises damage to or loss of sensitive flora. • Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the WEF to ensure that there is no uncontrolled access by construction vehicles and labourers. • Temporary construction lay-down or assembly areas will be sited on transformed areas. • Rapid regeneration of plant cover will be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion. • Rehabilitation or ecological restoration during and after the construction phase will be undertaken with indigenous plants with input from a botanist with experience in restoration of arid Karoo areas (see Section 8) • Remove alien vegetation from disturbed areas (see Section 6) • During construction in areas classified as high sensitivity areas, an ecologist should be consulted to ensure micro-siting of turbines minimises damage to or loss of sensitive habitat. • Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the WEF to ensure that there is no uncontrolled	On-going	❖ Contractor ❖ Appointed botanist ❖ ECO

Aspect	Objective	Action	Frequency	Responsible Party
		access by construction vehicles and labourers. • All vehicles must stick to designated and prepared roads. • Temporary construction lay-down or assembly areas should be sited on transformed areas. • Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion. • Control poaching by banning dogs on site and enclosing worker compounds.		
Destruction of natural vegetation	Avoid the loss of Plant Species of Special Concern.	• The final footprint of each turbine, as well as support infrastructure should be subject to specific evaluation	Once-Off	❖ Project Developer
6.4.6 Freshwater ecology				
Impact on Surface and Groundwater	Minimise impacts on surface and groundwater	• Soil stockpiles will be protected from wind or water erosion through placement, vegetation or appropriate covering. • Proper drainage controls such as culverts, cut-off trenches will be used to ensure proper management of surface water runoff to prevent erosion. • Cleared or disturbed areas will be rehabilitated as soon as possible to prevent erosion. • Fuel, oil and used oil storage areas will have appropriate secondary containment (ie bunds). • Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of to a licensed landfill by a licensed operator. • Construction vehicles and equipment will be serviced regularly and provided with drip trays, if required. • Workshop areas will be lined to prevent subsurface ingress of contaminants and drainage from these areas will not be allowed to drain into water courses.	On-going	❖ Contractor ❖ ECO

Aspect	Objective	Action	Frequency	Responsible Party
6.4.7 Agriculture and soil potential				
Loss of Topsoil, Soil Compaction and Erosion	➢ Minimise erosion and loss of topsoil	• Restrict removal of vegetation and soil cover to the development footprint. • Implement soil conservation measures such as stockpiling top soil for remediation of disturbed areas. Topsoil storage should be as brief as possible and rehabilitation areas must be fenced off to protect plants until plant communities are adequately developed. • Proper drainage controls such as culverts, cut-off trenches will be used to ensure proper management of surface water runoff to prevent erosion. • Soil stockpiles should be vegetated or appropriated covered to reduce soil loss as a result of wind or water to prevent erosion; • Disturbed areas will be rehabilitated as soon as possible to prevent erosion (see Section 8 and 12); • Construction vehicles will remain on designated and prepared roads. • Minimise the damage caused by construction activities to the farmland by ensuring strict compliance with construction plans and worker 'Code of Conduct'. • Any damage to vegetation will be rehabilitated in accordance with mitigation proposed for the rehabilitation of natural vegetation (see Section 8).	On-going	❖ Contractor ❖ ECO
6.4.8 Visual Resources				
Construction activities	➢ Reduce the impact of loss of visual resources	• Night time construction should be avoided where possible. • Night lighting of the construction sites should be minimised within requirements of safety and efficiency • Setbacks around key sensitive visual receptors must be implemented.	Continually	❖ Contractor ❖ ECO
			Continually	❖ Contractor ❖ ECO

Aspect	Objective	Action	Frequency	Responsible Party
6.4.9 Air Quality				
Dust and emissions	➢ Limit fugitive dust and exhaust emissions	• Vehicles travelling on gravel roads should not exceed a speed of 40km/h. • Where appropriate, straw should be laid on exposed ground to prevent fugitive dust. • Containers for dusty materials will be enclosed or covered by suitable tarpaulins / nets to prevent escape of dust during loading and transfer from site. • Where necessary, stock piles of soil must be covered by suitable shade cloth or netting to prevent erosion, fugitive dust and to prevent the escape of dust during loading and transfer from site. • Vehicles are too kept in good working order and serviced regularly to minimise emissions. • Any complaints received from neighbours or site users must be reported to the Mainstream SA Project Manager and measures must be taken to limit dust.	On-going	❖ Contractor ❖ ECO
6.4.10 Noise				
Noise pollution	➢ Avoid disturbing surrounding landusers.	• Vehicles and equipment used on site must be in good condition and serviced regularly. • Construction activities will be restricted to regular working hours, as far as possible. • Mechanical equipment with lower sound power levels must be selected to ensure that permissible occupation noise-rating limit of 85 dBA is not exceeded. • Construction workers and personnel must wear hearing protection when required. • A grievance procedure will be established whereby complaints are recorded and responded to.	On-going	❖ Contractor ❖ ECO

Aspect	Objective	Action	Frequency	Responsible Party
Noise pollution	➢ Avoid disturbance to Noise Sensitive Developments	• The potential noise impact must again be evaluated should the layout be changed where any wind turbines are located closer than 1,000 m from a confirmed NSD. • The sound power emission level of the selected wind turbine must remain below 110 dBA. • The developer must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from location where construction activities are taking place or operational wind turbine.	Ongoing	❖ Contractor ❖ ECO
6.4.11 Health and safety				
Health and Safety	➢ Ensure the health and safety of subcontractors and site users	• A health and safety plan must be developed prior to the commencement of construction to identify and avoid work related accidents. This plan must be adhered to by the appointed construction contractors and meet Occupational Health and Safety Act (OHSAct), Act 85 of 1993, requirements. • Potentially hazardous areas must be clearly demarcated (i.e. unattended foundation excavations). • Appropriate PPE must be worn by construction personnel	On-going	❖ Contractor ❖ ECO
6.4.12 Traffic Impact				
Traffic Impact	➢ Mitigate traffic impacts	• The traffic management plan will be adhered to including adherence to speed limits and 'rules of the road' (see Section 17) • All directly affected and neighbouring farmers and local residents will be able to lodge grievances with Mainstream using the Grievance Procedure regarding dangerous driving or other traffic violations that could be linked to the project.	On-going	❖ Contractor ❖ ECO
6.4.13 Socio-economic				
Socio-cultural issues	➢ Minimize impacts associated with influx of jobseekers. ➢ Minimise damage to	• Mainstream's code of conduct developed prior to the construction phase must be adhered to. • The HIV Policy developed prior to the commencement of construction must be adhered to.	On-going	❖ Project Developer

Aspect	Objective	Action	Frequency	Responsible Party
	agricultural land and stock losses, minimize disruption to current farm regimes.	• The construction workers (from outside the area) should be allowed to return home over the weekends or on a regular basis to visit their families; the contractor should make the necessary arrangement to facilitate these visits. • Mainstream SA will implement a grievance procedure that is easily accessible to local communities, complaints related to contractor or employee behaviour can be lodged and responded to.		

6.5 Operational phase

Aspect	Objective	Action	Frequency	Responsible Party
6.5.1 Avifauna				
Avian collisions	➢ Monitor potential injury to avifauna and fatalities	• Carefully monitor collision incidence and investigate appropriate mitigation measures, when required. • A register must be maintained of injuries to avifauna, complaints or queries received as well as any action taken. • Maintenance activities should be scheduled to avoid disturbances to sensitive areas (identified through operational monitoring) during breeding season.	On-going	❖ Operations and maintenance contractor ❖ Ornithologist as advisor ❖ ECO
6.5.2 Bats				
Mortality of bats due to collisions	➢ Monitor fatalities	• Carefully monitoring collision incidence and investigate appropriate mitigation measures, when required. • A register must be maintained of injuries to bats, complaints or queries received as well as any action taken.	On-going	❖ Operations and maintenance contractor ❖ Bat specialist as advisor ❖ ECO
Mortality of bat due to collisions	➢ Monitor fatalities	• All turbines must be curtailed below cut in speed and not allow for freewheeling from the start of operation. Bat activity is markedly higher over low wind speed periods. Preventing freewheeling should not affect energy production significantly, but will be a substantial bat conservation mitigation measure.	Ongoing	❖ Operations and maintenance contractor ❖ Bat specialist as advisor ❖ ECO

		• An operational bat monitoring study should already be in place at the start of the wind farm operation and should be implemented immediately after construction of turbines. Mitigation measures outlined by the bat specialist during the operational monitoring study should be applied with due diligence.		
6.5.3 Fauna and flora				
Loss of Vegetation	Minimise impacts associated with loss of vegetation	• On-site employees, farm workers and visitors to the site will be educated about the conservation of vegetation. This will include strict guidelines for remaining on existing roads while on site to avoid unnecessary destruction or damage to undisturbed and rehabilitated vegetation. • It is understood that lease agreements are in place but it is recommended that landowners are encouraged to ensure livestock numbers are kept at or below densities recommended by the Department of Agriculture to prevent over-grazing. • A fire management policy and guidelines will be developed to ensure that the operation of the WEF is compatible with the long-term fire ecology of the site (see Section 11) • Remove alien vegetation from any disturbed areas (see Section 6).		❖ Contractor ❖ ECO
6.5.4 Agriculture and soil potential				
Loss of Topsoil, Soil Compaction and Erosion	➢ Minimise erosion	Bi-annual monitoring of erosion in the vicinity of the turbines, roads, and other hard-standing surfaces will be conducted before and after the rainy season to ensure erosion sites can be identified early and remedied.	Bi-annually	❖ Operations and maintenance contractor ❖ ECO
6.5.5 Visual Resources				
Visual impacts	➢ Minimize the visual impacts during the operation phase.	• Signage related to the WEF must be discrete and confined to entrance gates. • A shadow flicker study must be undertaken if turbines are to be placed with 10 blade lengths of a dwelling on site.	On-going	❖ Operations and maintenance contractor ❖ ECO

6.5.6 Health and Safety				
Health and Safety	➢ Maintain health and safety standards	• Regular maintenance of turbines and all other infrastructure must be undertaken to ensure optimal functioning and reducing the chance of gearbox failure. • Regular inspections of the turbine foundations, towers, blades, spinners and nacelle must be undertaken in order to check for early signs structural fatigue.	On-going	❖ Operations and maintenance contractor
6.5.7 Socio-economic				
Tourism	➢ Enhance tourism impacts	• An information notice board at the nearest town (Sutherland) to facilitate educating the public about the need and benefits of project. This is aimed at instilling the concept of sustainability and creating awareness by engaging the community and local schools. Information brochures and posters must be made available at the kiosk that will provide more information about the facility. These should be presented in the appropriate languages to maximise the benefits.	Once-off	❖ Project Developer
6.5.8 Electromagnetic Interference				
Electromagnetic Interference	➢ Prevent EMI effects	• Appropriate mitigation measures might include the replacement of receiving aerial installations, replacement by satellite dishes or the provision of a private transmitter.	Once-off	❖ Project Developer
6.5.9 Traffic				
Traffic	Minimise traffic impacts	• During operation, if abnormal loads are required for maintenance, the appropriate arrangements will be made to obtain the necessary transportation permits and the route agreed with the relevant authorities to minimise the impact of other road users. • All internal and access roads that will be used by Mainstream during the operational phase of the project must be maintained	On-going	❖ Operations and maintenance contractor ❖

6.6 Decommissioning phase

Aspect	Objective	Action	Frequency	Responsible Party
6.6.1 Agriculture and soil potential				
Impact to soil potential	➢ Erosion	• Implement an effective system of storm water run-off control. See Section 12 of this EMPr	On-going	❖ Contractor ❖ ECO
Decommissioning activities that disturb the soil profile.	➢ Loss of topsoil	• Strip, stockpile and re-spread topsoil during rehabilitation	Continually as required	❖ Contractor ❖ ECO
Vehicle traffic and dust generation	➢ Degradation of veld vegetation	• Control vehicle passage and control dust	Continually as required	❖ Contractor ❖ ECO
6.6.2 Visual Resources				
Visual impact	➢ Visual impact of decommissioning activities on existing views of sensitive visual receptors	• Rehabilitation of cleared and disturbed areas. • Working at night should be avoided, where possible. • Night lighting of reclamation sites should be minimised within requirements of safety and efficiency	Continual	❖ Operations and maintenance contractor ❖ ECO
6.6.3 Avifauna				
Avifaunal impact	➢ Minimise disturbance to birds	• Minimise the disturbance impacts associated with the decommissioning of the line by abbreviating decommissioning time	Once-off	❖ Contractor ❖ Appointed ornithologist ❖ ECO

7. Alien Invasive Management Plan

OBJECTIVE: Avoid the establishment and spread of alien invasive species during all phases of the development

- The site should be monitored for erosion and alien plant invasion for a period of at least two years after the infrastructure has been removed to ensure that rehabilitation is successful and that areas that do not recover adequately can be identified and remedied.
- Proliferation of alien and invasive species is expected within any disturbed areas particularly as there is a degree of alien and invasive species within the study area at present. These species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, closure/decommissioning and rehabilitation/ maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species;
  - No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented.
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
- Vehicles should be thoroughly washed prior to moving them into the project area, to reduce the risk of introducing seeds of potentially invasive species

8. Plant Rescue and Protection Plan

OBJECTIVE: Avoid and mitigate potential impacts to listed and protected plant species and their habitats

- Removal of vegetation must be followed closely by rehabilitation by specialists qualified in this vegetation type's remediation.
- Prevent and manage the establishment of alien vegetation (as per Alien Invasive Management Plan, Section 6 of this EMPr)
- Minimise removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring.
- All disturbed sites must be rehabilitated.
- Remediation must be completed by qualified personnel with the correct equipment in the correct season (wet season).

9. Re-vegetation and Habitat Rehabilitation Plan

OBJECTIVE: Re-vegetate open areas and rehabilitate disturbed areas

- The Contractor must ensure that all equipment and materials used or created on-site for or during installation activities are removed after installation.
- All excess installation equipment and excess aggregate, gravel, stone, poles, concrete and the like will be removed from the site upon completion of the work.
- No discarded materials of any nature shall be buried.
- Soils compacted during construction activities should be ripped and reprofiled and reseeded with indigenous vegetation.
- To prevent the erosion of soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas particularly susceptible to erosion;
- Install erosion berms during construction to prevent gully formation. Berms every 50m should be installed where any disturbed soils have a slope of less than 2%, every 25m where the track slopes between 2% and 10%, every 20m where the track slopes between 10% and 15% and every 10m where the track slope is greater than 15%;
- Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags;
- Maintain topsoil stockpiles below 5 meters in height;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and
- Monitor all areas for erosion and incision, particularly any freshwater resource crossings. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible and in conjunction with other role players in the catchment
- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat;
- Rehabilitate all wetland and riparian habitat areas possibly affected by the proposed electrical infrastructure operations to ensure that the ecology of these areas is re-instated during all phases.
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;
- As much vegetation growth as possible should be promoted within the proposed electrical infrastructure construction area in order to protect soils;
- All alien vegetation identified should be removed from rehabilitated areas and reseeded with indigenous vegetation as specified by a suitably qualified specialist (ecologist);
- All areas affected by the electrical infrastructure construction should be rehabilitated upon completion of the electrical infrastructure construction;
- Riparian vegetation cover should be monitored to ensure that sufficient vegetation is present to bind the bankside soils and prevent bankside erosion and incision; and
- It is recommended that a detailed rehabilitation plan be developed by a suitably qualified ecologist during the operations phase in order to address specific rehabilitation requirements.
- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.

10. Open Space Management Plan

OBJECTIVE: Prevent occurrence of excessive open areas

- Minimise removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring
- Removal of vegetation must be followed closely by rehabilitation by specialists qualified in this vegetation type's remediation.
- Vegetate and irrigate open areas to limit erosion, but take care not to promote erosion by irrigating.

11. Storm Water Management Plan

OBJECTIVE: Manage storm water runoff to prevent adverse impacts to terrestrial and aquatic ecosystems.

- Implement an effective system of storm water run-off control using bunds and ditches, where it is required (at points where water accumulation might occur).
- Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.
- Stormwater run-off will be discharged away from water courses (drainage channels, streams or dams). Effluent from construction site offices and staff facilities will be collected in storage tanks, which will be removed by a licensed sanitary contractor.
- Effluent from the batching plant will be contained within a bunded area and not be allowed to drain into water courses. Effluent will be recycled or removed.

12. Fire Management Plan

OBJECTIVE: Reduce the risk of fire in the grassland environment

- Construct fire-breaks around the site/footprint area before any other construction begins.
- Prohibit smoking on-site or alternatively indicate designated smoking areas for staff.
- Prohibit open fires.
- Designate cooking areas for staff where fire hazard will be insignificant.
- Educate staff of the dangers of open and unattended fires.
- Educate staff as to proper fire safety.
- Enforce proper waste management including disposal of flammable material (e.g. cigarette butts and packaging).
- Place firefighting equipment at appropriate locations on site and ensure staff are aware of such equipment and associated procedure.
- No fires are allowed around the construction area.
- Welding, gas cutting or cutting of metal will only be permitted in an area designated as safe by the subcontractor.

13. Erosion Management Plan

OBJECTIVE: Prevent soil erosion and rehabilitate eroded areas.

- Establish an effective record keeping system for each area where soil is disturbed for constructional and decommissioning purposes. Recommendations for the recording system are included in the EMPr
- Any area where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible to keep the freshwater resources habitat and its ecological structure in place

14. Leakage / Spillage Monitoring System

OBJECTIVE: Prevent and monitor accidental leakages and spillages

- All hazardous chemicals should be stored on bunded surfaces and no storage of such chemicals should be permitted within the riparian buffer zones
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; and
- All spills, should they occur, should be immediately cleaned up and treated accordingly
- All vehicles and other equipment (generators etc.) must be regularly serviced to ensure they do not spill oil. Vehicles should be refuelled on paved (impervious) areas. If liquid product is being transported it must be ensured this does not spill during transit.
- Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.
- Diesel fuel storage tanks must be above ground in a bunded area.
- Engines that stand in one place for an excessive length of time must have drip trays.
- Vehicle and washing areas must also be on paved surfaces and the by-products removed to an evaporative storage area or a hazardous waste disposal site (if the material is hazardous).
- Establish an effective record keeping system for accidental leakage/spillage incidents.
- Excess or spilled concrete should be confined within the work area and then removed to a licensed landfill site.
- Concrete shall be mixed on mortar boards, away from drainage channels and water courses.
- The visible remains of the mixing of concrete, either solid or from washings, shall be physically removed and disposed of as waste at a licensed landfill site.
- All excess aggregate shall also be removed from site.

15. Protection of Hydrological Features Measures

OBJECTIVE: Prevent groundwater contamination

- Ensure that as far as possible all infrastructure is placed outside of freshwater resource areas and their respective buffer zones. If these measures cannot be adhered to, strict mitigation measures, will be required to minimize the impact on the receiving watercourses;
- Permit only essential construction personnel within 32m of the freshwater habitat, if absolutely necessary that they enter the regulatory zone;
- Limit the footprint area of the construction activities to what is only essential in order to minimise environmental damage;
- During the construction phase, no vehicles should be allowed to indiscriminately drive through the freshwater resource areas; and
- Implement effective waste management in order to prevent construction related waste from entering the freshwater environments.
- All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; and
- All spills, should they occur, should be immediately cleaned up and treated accordingly.

16. Waste Management Plan

OBJECTIVE: Promote proper waste disposal, waste reduction, re-use, and recycling opportunities

- A suitable area for the storage of waste must be selected (away from water courses) and included in the site layout plan.
- Ensuring that an adequate number of rubbish and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills
- Implement effective waste management in order to prevent construction related waste from entering the freshwater environments.
- Ensure an adequate and sustainable use of resources.
- Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.
- All operational waste (concrete, steel, rubbles etc.) to be removed from the site and waste hierarchy of prevention, as the preferred option, followed by reuse, recycling, recovery must be implemented, where possible.
- Other non-hazardous solid waste (e.g. packaging material) to be disposed of at a licensed landfill.
- All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.
- Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.
- Waste water from construction and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.
- Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.
- Vegetative material will be kept on site and mulched after construction to be spread over the disturbed areas to enhance rehabilitation of the natural vegetation.
- The subcontractor shall not dispose of any waste and/or construction debris by burning or burying.
- Off-cuts (steel, wood etc) will be re-used or recycled, as far as possible.

17. A transportation plan

OBJECTIVE: Manage the transportation of turbine components, main assembly cranes and other large pieces of equipment

- A transport study must be undertaken prior to construction to determine the most appropriate route from port to site.
- Wind turbine components will be delivered to site using road transport and due to the size of the components, the vehicles used to deliver turbine components will be considered abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989).
- A permit for a vehicle carrying an abnormal load must be obtained from the relevant Provincial Authority.
- The vehicle must comply with the Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads, issued by the Department of Transport, 2009.

18. A traffic management plan

OBJECTIVE: Manage the traffic generation of the project

- Adhere to existing roads and road rules associated with them (for instance speed limits).
- Obtain permits from relevant administrative authority in the event of abnormal load transportation to and from site.
- Strictly regulate speed limit of construction vehicles.
- Demarcate and strictly control parking areas so that vehicles are limited to specific areas only;
- Ensure that roadworthy and safety standards are implemented for construction vehicles.
- Avoid construction vehicles movement on public roads during peak traffic times (06-00 – 09:00 and 16:00 – 19:00).
- Implement clear and visible signalling to indicate the movement of vehicles and when turning onto or off access roads to ensure safe access to and from the site.
- Maintain the pre-construction condition of public roads being utilised by construction vehicles. Pre-construction condition of roads should be supported by photographic evidence for record-keeping.
- In the event that the condition of public roads being used by construction vehicles are significantly degraded due to use, the developer should restore road condition to its pre-construction condition.

19. An avifauna and bat monitoring programme

OBJECTIVE: Ensure that the monitoring of avifaunal flight patterns and presence of bats are monitored on site

BIRD MONITORING

The latest bird monitoring guidelines must be adhered to:

The bird monitoring must comply to the "The "Best Practice Guidelines for Avian Monitoring and Impact Mitigation at Proposed Wind Energy Development Sites in Southern Africa", (Jenkins et al. 2011) revised in 2015. It must also comply with 2 new sets of guidelines, one for Cape Vultures (Pfeiffer et al. 2018) and one for Verreaux's Eagles (Ralston-Patton 2017).

The primary aims of a long-term monitoring programme would be to:

- Determine the densities of birds resident within the impact area of the WEF before construction of the facility, and afterwards, once the facility, or phases of the facility, become operational.
- Document patterns of bird activity and movements in the vicinity of the proposed WEF before construction, and afterwards, once the facility is operational.
- Monitor patterns of bird activity and movement in relation to weather conditions, time of day and season for at least a full calendar year after the WEF is commissioned.
- Register and as far as possible document the circumstances surrounding all avian collisions with the WEF turbines for at least a full calendar year after the facility becomes operational.

Avian densities

A set of at least 10 walk-transect routes, each of at least 1000 m in length, should be established in areas representative of all the avian habitats present within a 10 km radius of the centre of the WEF development site. Each of these should be walked at least once every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the WEF is commissioned. The transects should be walked after 06h00 and before 09h00, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison.

In addition, the cliff-lines within the development area should surveyed for cliff-nesting raptors at least every six months using documented protocols (Malan 2009), and all sightings of key species (Table 6.1) on site should carefully plotted and documented, and the major waterbodies on and close to the development area should be surveyed for wetland species on each visit to the study area, using the standard protocols set out by the CWAC initiative (Taylor et al. 1999).

Bird activity monitoring

Monitoring of bird activity in the vicinity of the WEF should be done over a 2-3 day period at least every two months for the six months preceding construction, and at least once per quarter for a full calendar year starting at least six months after the WEF is commissioned. Each monitoring day should involve:

- Half-day counts of all priority species flying over or past the WEF impact area; and
- Opportunistic surveys of cranes (and bustards) and raptors seen when travelling around the WEF site.

Avian collisions

Collision monitoring should have two components: (i) experimental assessment of search efficiency and scavenging rates of bird carcasses on the site, and (ii) regular searches of the vicinity of the wind farm for collision casualties.

Assessing search efficiency and scavenging rates

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed (Morrison 2002). To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, some time before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 20. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcassess are scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximize survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate (Osborn et al. 2000, Morrison 2002). Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates should be measured twice during the monitoring year, once in winter and once in summer.

Collision victim surveys

The area within a radius of at least 50 m of each of the turbines at the facility should be checked regularly for bird casualties (Anderson et al. 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period (see above), but they should be done at least weekly for the first two months of the study. The area around each turbine, or a larger area encompassing the entire WEF, should be divided into quadrants, and each should be carefully and methodically searched for any sign of a bird collision incident (carcasses, dismembered body parts, scattered feathers, injured birds). All suspected collision incidents should be comprehensively documented, detailing the precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence in situ. All physical evidence should then be collected, bagged and carefully labelled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box. The local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre. In such cases, the immediate area of the recovery should be searched for evidence of impact with the turbine blades, and any such evidence should be fully documented (as above).

In tandem with surveys of the wind farm for collision casualties, the vicinity of the solar installation should be searched for any signs of avian interaction with the hardware – mortalities, nest building, regular perch or roosting sites, nest sites, and these should documented.

BAT MONITORING REQUIREMENTS

The latest bat guidelines must be adhered to:

"Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Forssman, K. and Lötter, C. (2017). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Edition 4.1. South African Bat Assessment Association".

The operational WEF will be regularly monitored for bat activity and bat mortality as follows:

- Acoustic monitoring will be done at one or two randomly chosen towers at each site during the periods of migration and mid-summer.
- The acoustic monitoring will be accompanied by monitoring for bat fatalities at one or two randomly chosen towers at each facility by walking two concentric spiral transects 7m apart with the larger spiral starting at 50m from the tower.

Appendix A – CV of the EAP

Curriculum Vitae: Minnelise Levendal –
EAP and Project Leader

Name of firm:	CSIR
Name of staff	Minnelise Rouchelle-Ann Levendal
Profession:	Environmental Assessment Practitioner/Project Manager
Position in firm:	Senior Environmental Assessment Practitioner
Years' experience:	18 years
Nationality:	South African
Languages:	Afrikaans and English
Affiliation:	SACNASP Registered Professional Natural Scientist (Registration Number: 117078)

1. BIO-SKETCH:

Minnelise has more than 15 years of experience in environmental assessment and management, and is a Senior Environmental Assessment Practitioner (EAP) in the Environmental Management Services (EMS) group of the CSIR in Stellenbosch. She is a Registered Professional Natural Scientist (Registration Number: 117078) with the South African Council for Natural Scientific Professions (SACNASP). Minnelise has experience in the management and integration of various types of environmental assessments in South Africa for various sectors, including renewable energy and industry. Minnelise has undertaken several Environmental Assessments for wind farms and solar PV farms (i.e. EIAs, BAs, and Amendment and Appeal Processes) in the Northern Cape, Western Cape and Eastern Cape. Minnelise is currently the project leader for the Amendment processes for the adjacent Sutherland, Sutherland 2, and Sutherland 2 WEFs, which received positive Environmental Assessments.

A list of projects she had undertaken is provided below.

2. EDUCATION

▪ M.Sc. (Botany)	Stellenbosch University	1998
▪ B.Sc. (Hons.) (Botany)	University of the Western Cape	1994
▪ B.Sc. (Education)	University of the Western Cape	1993

3. PROFESSIONAL REGISTRATIONS / MEMBERSHIPS

- International Association for Impact Assessment (IAIA), Western Cape (member of their steering committee from 2001-2002).
- Professional Natural Scientist (Pr.Sci.Nat) – 117078)

4. EMPLOYMENT RECORD

Name of current employer	Position	From	To
CSIR (Environmental Management Services-EMS);	Senior Environmental Assessment Practitioner	2006	Present
CSIR (Natural Resources and the Environment)	Environmental Researcher	2004	2006
Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)	Assistant Director	2003	2004
	Principal Environmental Officer	2002	2003

	Principal Environmental Officer	2002	2003
	Senior Environmental Officer	2001	2002
	Environmental Officer	1999	2000
University of the Western Cape	Junior Lecturer	1996	1996
Cape Peninsula University of Technology	Junior Lecturer	1995	1995

5. KEY COURSES

- Public Participation in Environmental Authorisation in South Africa: IAIA workshop presented by Tisha Greyling and Erika Du Plessis (2016).
- Environmental Law: Shepstone Wylie Attorneys; Presented by Janice Tooley (2015).
- Sharpening the Tool: New techniques and methods in Environmental Impact Assessment: Sustainable Environmental Solutions (Pty) Ltd (2015).
- Effective Skills for Challenging Meetings & Engagements: Conflict Dynamics (2015).
- Science Communication and Working with the Media: Proof Communications/Jive Media Africa (2014).
- Leadership, Innovation and Change Management: University of Stellenbosch (Business School) (2013).
- MS Project: CILLA (2011).
- Project Management I and II: CILLA (2005)
- Social Impact Assessment: IAIA workshop (2002)
- Environmental Law ("The New Environmental Law Course for Environmental Managers): University of Potchefstroom: Center for Environmental Management) (2002).
- Implementing Environmental Management Systems (SABS/ISO 14001:1996): University of Potchefstroom: Center for Environmental Management (2002).
- Conflict Management in Environmental Issues: University of Potchefstroom: Center for Environmental Management) (2001).

6. PROJECT EXPERIENCE RECORD

The following table presents a list of key projects undertaken by Minnelise Levendal at the CSIR to date, as well as the role played in each project:

Environmental Impact Assessment (EIAs) and Basic Assessments (BAs)-including their respective Environmental Management Programmes (EMPRs):

Completion Date	Project description	Role	Client
2019	Amendment Application for the proposed Kuruman Phase 1 Wind Energy Facility near Kuruman in the Northern Cape	Project Leader and EAP	Mulilo Renewable Project Developments (Pty) Ltd
2019	Amendment Application for the proposed Kuruman Phase 2 Wind Energy Facility near Kuruman in the Northern Cape	Project Leader and EAP	Mulilo Renewable Project Developments (Pty Ltd
2019	Substantive Amendment Application for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape	Project Leader and EAP	juwi Renewable Energies (Pty) Ltd
2019	Substantive Amendment Application for the proposed Rietrug Wind Energy Facility near Sutherland in the Northern Cape	Project Leader and EAP	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2019	Substantive Amendment Application for the proposed Sutheland Wind Energy	Project Leader and EAP	South Africa Mainstream Renewable Power

Completion Date	Project description	Role	Client
	Facility near Sutherland in the Northern and Western Cape		Developments (Pty) Ltd
2019	Substantive Amendment Application for the proposed Sutherland 2 Wind Energy Facility near Sutherland in the Northern Cape	Project Leader and EAP	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2019	BA for the proposed Gromis wind farm near Kleinzee in the Northern Cape	Project Leader and EAP	ENERTRAG South Africa (Pty) Ltd
2019	BA for the proposed Komas wind farm near Kleinzee in the Northern Cape	Project Leader and EAP	ENERTRAG South Africa (Pty) Ltd
2019	BA for the proposed electrical infrastructure for the Gromis wind farm near Kleinzee in the Northern Cape	Project Leader and EAP	ENERTRAG South Africa (Pty) Ltd
2019	BA for the proposed electrical infrastructure for the Komas wind farm near Kleinzee in the Northern Cape	Project Leader and EAP	ENERTRAG South Africa (Pty) Ltd
2018-2019	BA for the proposed Kudusberg WEF near Sutherland in the Northern and Western Cape	Project Leader and EAP	G7 Renewable Energies (Pty) Ltd
2017-2018	EIA for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape	Project Leader and EAP	juwi Renewable Energies (Pty) Ltd
2018	BA for the proposed electrical infrastructure to support he proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape	Project Leader and EAP	juwi Renewable Energies (Pty) Ltd
2015-2016	EIA for the Gemsbok Solar Photovoltaic, PV 3 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Gemsbok Solar PV 4 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Gemsbok Solar PV 5 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Gemsbok Solar PV 6 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Boven Solar PV 2 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Boven Solar PV 3 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2015-2016	EIA for the Boven Solar PV 4 near Kenhardt in the Northern Cape	Project Manager and EAP	Mulilo Renewable Project Developments
2010-2011 (EA Granted)	EIA for the proposed Ubuntu wind energy project, Eastern Cape	Project Manager	WKN Windkraft SA
2010-2011 (EA granted)	EIA for the proposed Banna Ba Pifhu wind energy project, Eastern Cape	Project Manager	WKN Windkraft SA
2010-2011 (EA granted)	BA for a powerline for a WEF near Swellendam in the Western Cape	Project Manager	BioTherm Energy (Pty Ltd
2010-2011 (EA Granted)	EIA for a proposed wind farm near Swellendam in the Western Cape	Project Manager	BioTherm Energy (Pty Ltd
2010 (EAs granted)	Basic Assessment for the erection of two wind monitoring masts near Swellendam and Bredasdorp in the Western Cape	Project Manager	BioTherm Energy (Pty Ltd
2010	Basic Assessment for the erection of two	Project Manager	Windcurrent (Pty Ltd

Completion Date	Project description	Role	Client
(complete)	wind monitoring masts near Jeffrey's Bay in the Eastern Cape		
2009-2010 (EAs granted)	Basic Assessment Process for the proposed erection of 10 wind monitoring masts in SA as part of the national wind atlas project	Project Manager	Department of Energy through SANERI; GEF
2009 (EAs granted)	Basic Assessment Report for a proposed boundary wall at the Port of Port Elizabeth, Eastern Cape	Project Manager	Transnet Ltd
Other Environmental Assessments, Strategies, Biodiversity Management Plans, Frameworks and Reporting tools:			
2014-2018	Special Needs and Skills Development Programme	Project Leader	DEA
2013-2014	Development of a National Management Plan and Strategy for Invasive Alien species	Project Manager	DEA
2012-2014	Development of a Biodiversity Management Plan for the African Lion (*Panthera leo*)	Project Manager	DEA
2010	South Africa's Second National Communication under the United Nations Framework Convention on Climate Change	Project Manager	SANBI
2008	The development of protocols for the monitoring and evaluation of benefits arising from the Working for Water Programme (2008).	Project manager	DEA
2006-2008	Monitoring and Evaluation of aspects of Biodiversity	Project Leader	Internal project awarded through the Young Researchers Fund
2006	Integrated veldfire management in South Africa. An assessment of current conditions and future approaches.	Co- author	Working on Fire
2004-2005	Biodiversity Strategy and Action Plan Wild Coast, Eastern Cape, SA	Co-author	Wilderness Foundation
2005	Western Cape State of the Environment Report: Biodiversity section. (Year One).	Co- author and Project Manager	Department of Environmental Affairs and Development Planning

7. AWARDS

- 2008: Best presentation Award at Arid Zone Conference (Northern Cape)
- 2015: CSIR award for Human Capital Development: Special Needs and Skills Development Programme

8. CONFERENCE PRESENTATIONS & PAPERS

- **Levendal, M**. (2012). "Challenges in the Environmental Assessment of Renewable Energy Projects in South Africa" In IAIA (Portugal) Conference Proceedings.
- **Bowie, M.** (néé Levendal) (1998). "Ecophysiological responses of four succulent Karoo species under different temperature and water regimes." In *Arid Zone Conference (Northern Cape) Conference Proceedings*.

9. PUBLICATIONS

- **Bowie, M.** (néé Levendal) and Ward, D. (2004). Water status of the mistletoe Plicosepalus acaciae parasitic on isolated Negev Desert populations of Acacia raddiana differing in level of mortality. Journal of Arid Environments 56: 487-508.

- Wand, S.J.E., Esler, K.J. and **Bowie, M.R** (2001). Seasonal photosynthetic temperature responses and changes in 13C under varying temperature regimes in leaf-succulent and drought-deciduous shrubs from the Succulent Karoo, South Africa. South African Journal of Botany 67:235-243.
- **Bowie, M.R.,** Wand, S.J.E. and Esler, K.J. (2000). Seasonal gas exchange responses under three different temperature treatments in a leaf-succulent and a drought-deciduous shrub from the Succulent Karoo. South African Journal of Botany 66:118-123.

10. LANGUAGE CAPABILITY

Language	***Speaking***	***Reading***	***Writing***
English	*Excellent*	*Excellent*	*Excellent*
Afrikaans	*Excellent*	*Excellent*	*Excellent*

Minnelise Levendal

September 2019

Appendix B– Coordinates of the turbine positions of the Sutherland WEF

SUTHERLAND WEF		
Turbine number	**Lat (Y)**	**Long (X)**
1	32° 38' 34,437" S	20° 54' 43,182" E
2	32° 38' 27,750" S	20° 54' 2,822" E
3	32° 38' 7,722" S	20° 54' 55,022" E
4	32° 37' 49,417" S	20° 55' 58,217" E
5	32° 39' 25,133" S	20° 53' 43,177" E
6	32° 38' 36,524" S	20° 55' 56,692" E
7	32° 38' 7,133" S	21° 1' 20,966" E
8	32° 38' 13,427" S	20° 59' 9,995" E
9	32° 37' 47,283" S	20° 59' 2,744" E
10	32° 38' 10,359" S	20° 58' 31,725" E
11	32° 37' 47,559" S	20° 57' 55,804" E
12	32° 38' 11,679" S	20° 57' 40,913" E
13	32° 38' 11,671" S	20° 57' 7,669" E
14	32° 38' 20,363" S	20° 56' 44,992" E
15	32° 39' 1,597" S	20° 56' 31,962" E
16	32° 38' 41,704" S	20° 56' 34,277" E
17	32° 37' 47,016" S	20° 57' 22,051" E
18	32° 38' 6,449" S	20° 55' 46,100" E
19	32° 37' 51,706" S	20° 55' 4,840" E
20	32° 38' 44,634" S	20° 53' 54,625" E
21	32° 37' 45,783" S	20° 56' 28,638" E
22	32° 38' 20,310" S	20° 53' 11,720" E
23	32° 38' 37,180" S	20° 55' 18,887" E
24	32° 38' 0,396" S	21° 0' 25,333" E
25	32° 37' 45,793" S	20° 54' 12,302" E
26	32° 37' 54,110" S	20° 52' 44,623" E
27	32° 38' 33,867" S	21° 0' 33,007" E
28	32° 38' 2,249" S	20° 53' 23,978" E
29	32° 37' 48,330" S	21° 1' 45,171" E
30	32° 38' 10,663" S	20° 59' 40,837" E
31	32° 39' 6,157" S	20° 53' 46,268" E
32	32° 37' 48,790" S	20° 58' 30,208" E
33	32° 37' 48,590" S	20° 52' 3,332" E
34	32° 38' 7,915" S	20° 54' 18,480" E
35	32° 38' 41,334" S	21° 1' 24,522" E
36	32° 37' 46,866" S	20° 53' 35,742" E
37	32° 38' 55,163" S	20° 54' 44,912" E
38	32° 37' 45,815" S	20° 59' 36,213" E
39	32° 38' 12,995" S	21° 1' 59,048" E