Turbine layout micrositing bat specialist comment, and Bat Mitigation Action Plan for inclusion into the updated EMPr

For the Rietrug Wind Energy Facility (WEF), Northern Cape, South Africa

Compiled by

Werner Marais

05 December 2022

PREPARED FOR:

Rietrug Wind Farm (Pty) Ltd

By

ANIMALIA CONSULTANTS

2015/364493/07

Somerset West

Cape Town

7130

Ref: R-2212-54

1 INTRODUCTION

Rietrug Wind Farm (Pty) Ltd received an Environmental Authorisation (EA) (DFFE Ref: 12/12/20/1782/1), dated 10/11/2016, for the development of a 140MW Wind Energy Facility (WEF) and associated infrastructure near Sutherland, and located within the Komsberg Renewable Energy Development Zone (REDZ), in the Northern Cape Province, with further amendments to the EA as stated below:

- Replacement of the first issue EA Reference: 12/12/20/1782/1 issued on: 10 November 2016;
- First Amendment - Amendment of Listed activities on the EA Reference: 12/12/20/1782/1/AM1 issued on 25 November 2016;
- Second Amendment – Amendment of turbine specifications & change of technical details of the proposed facility EA Reference: 12/12/20/1782/2/AM2 issued on: 25 August 2017;
- Third Amendment - Change in contact details of the holder of the EA & selected project description changes EA Reference: 12/12/20/1782/1/AM3 Issued on: 10 March 2020;
- Fourth Amendment – Name correction EA Reference: 12/12/20/1782/1/AM4 issued on 27 July 2021; and
- Fifth Amendment - Amendment to the co-ordinates of the access road EA Reference: 12/12/20/1782/1/AM5 issued on 06 December 2021.

The project will include (as authorised):

- Up to 37 wind turbines with a height of up to 200m and rotor diameter of up to 172m;
- The wind turbines will be connected to another by means of medium voltage cable;
- An internal gravel road network will be constructed to facilitate movement between turbines on site. These roads will include drainage and cabling;
- A hard standing laydown area of a maximum of 10 000m^2 will be constructed;
- A temporary site office will be constructed on site for all contractors, this would be approximately 5000m^2 in size; and

- A 10km portion of the existing access road will be upgraded and widened to a width of 7 m, to facilitate abnormal loads to the Rietrug WEF site.

The properties associated with the Rietrug WEF include:

- Portion 1 of Beeren Valley Farm 150;
- Remaining Extent of Beeren Valley Farm 150; and
- Remaining Extent of Nooitgedacht Farm 148.

Rietrug Wind Farm (Pty) Ltd will also share the on-site Acrux substation located on the adjacent Sutherland WEF site.

Rietrug Wind Farm (Pty) Ltd also received EAs for a new proposed onsite substation and associated electrical grid infrastructure, issued on 14 March 2022, for the Sutherland WEF in the Northern Cape Province of South Africa. The EA for the onsite substation has been split into an Independent Power Producer (IPP) Portion (EA Reference: 14/12/16/3/3/1/2458), Switching Station Portion and 132kV powerline (EA Reference: 14/12/16/3/3/1/2457/AM1). Both will be included in the layout for the Rietrug WEF, for completeness and to demonstrate its connection to the National Grid. The authorised Rietrug WEF and Sutherland WEF are located adjacent to each other and will operate as a cluster.

The infrastructure associated with the IPP Portion of the on-site substation (DFFE Ref: 14/12/16/3/3/1/2458) is located on Remaining Extent of Nooitgedacht Farm 148 and includes:

- IPP Portion of the on-site substation (Acrux);
- Laydown area;
- Operation & Maintenance Building;
- Fencing of the proposed on-site substation; and
- Battery Energy Storage Infrastructure (BESS).

The infrastructure associated with the Switching Station portion of the on-site substation and 132kV Powerline is located on Remaining Extent of Nooitgedacht Farm 148 (DFFE Ref: 14/12/16/3/3/1/2457/AM1) and includes:

- Switching Station portion of the on-site substation;

- Fencing;
- 132kV Powerline from the proposed Sutherland WEF on-site substation to the third party Koring MTS, including tower/pylon infrastructure and foundations;
- Connection to the Koring MTS third party substation;
- Service road below the powerline; and
- Switching Station portion of the on-site substation.

The Rietrug WEF will also consider the EA for Electrical Grid Infrastructure that supports the Sutherland, Sutherland 2 and Rietrug WEF projects, Northern & Western Cape Provinces (DFFE Ref: 14/12/16/3/3/1/2077/AM2), authorised within a 500m grid corridor.

The infrastructure associated with the electrical grid infrastructure project includes:

- Koring MTS, including O&M building and laydown area;
- Fencing of the proposed on-site substation;
- Overhead 132kV powerline from the Sutherland WEF on-site substation to the Koring MTS;
- Overhead 400kV powerline connecting to the proposed 400kV Koring MTS and an existing 400kV Eskom powerline; and
- Service roads will be constructed below the powerline (jeep tracks).

The properties associated with the Electrical Grid Infrastructure to support the Rietrug WEF includes:

- Remaining extent of Hartebeeste Fontein Farm 147;
- Remaining Extent of Nooitgedacht Farm 148;
- Remaining Extent of Beeren Valley Farm 150;
- Portion 1 of Farm 219;
- Remaining extent of Farm 219;
- Remaining extent of Farm 280;
- Portion 1 of Rheebokkenfontein Farm 4;
- Portion 2 of Rheebokkenfontein Farm 4;
- Portion 2 of De Molen Farm 5;
- Portion 6 of Hamelkraal Farm 16;

- Portion 7 of Farm Hamelkraal 16; and
- Remainder of Spitzkop Farm 20.

The Rietrug WEF has been awarded preferred bidder status in round 5 of the Renewable Energy IPP Procurement Programme (REIPPPP), and in order to meet financial close requirements and comply with the requirements of the EA (as amended), as per condition 16 and 18 which specifies that the applicant must submit a Final Layout plan and EMPr to the DFFE for written approval prior to commencement of the activity.

Nala Environmental (Pty) Ltd has been commissioned to undertake the Final Layout plan and EMPr approval process associated with the authorised WEF and its authorised grid infrastructure. As per the conditions of the relevant EAs, various specialist pre-construction walkthroughs have been undertaken to inform the placement of infrastructure for the Final Layout (including alignment for grid connection).

Animalia Consultants (Pty) Ltd concluded the 12-month pre-construction bat assessment in 2017, and has subsequently been appointed for the bat specialist verification of the final layout and to include mitigation measures for updating the EMPr for the WEF. **The specialist conducted 12 months of assessment on the project site and therefore no walkthrough was needed for this report**.

2 METHODOLOGY AND RESULTS

The bat sensitivity map was updated in 2016 (**Figure 2.1**).

Tables 2.1 & 2.2 below describes the implications of the sensitivity categories for the different infrastructure types of the WEF. No turbine blades are allowed to intrude into the high bat sensitivity buffer areas, therefore based on a 86m blade length, all turbine bases must be 86m or more from the edge of the 200m high bat sensitivity buffers indicated in **Figure 2.1.**

Based on a rotor diameter of 172m (i.e., 86m blade length), **no turbines or turbine blade overhang are intruding into the high bat sensitivity areas or their buffers**.

Table 2.1. Description of sensitivity categories and their significance in the sensitivity map.

Sensitivity	Description
High Sensitivity and its buffers	Areas that are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity/activity than the rest of the site. These areas are 'no-go' zones and turbines may not be placed in these areas and their buffers. Turbine blades (rotor swept diameter) also may not intrude into high sensitivity buffers.
Medium Sensitivity and its buffers	Areas of foraging habitat or roosting sites considered to have significant roles for bat ecology. Turbines are allowed within these areas and their buffers, but may require priority (not excluding all other turbines) during post-construction studies, and in some instances, there is a higher likelihood that mitigation measures may need to be applied to them due to seasonal bat activity fluctuations.

Table 2.2: The significance of sensitivity map categories for each infrastructure component.

Sensitivity	Turbines	Roads and cables	Internal overhead transmission lines	Buildings (including substation, battery storage facility and construction camp/yards)
High Sensitivity	These areas are 'no-go' zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Preferably keep to a minimum within these areas, where practically feasible.	Allowed inside these areas.	Avoid these areas (no-go areas).
High Sensitivity buffer	These areas are 'no-go' zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Allowed inside these areas.	Allowed inside these areas.	Preferably keep to a minimum within these areas, where practically feasible.
Moderate Sensitivity	Turbines within these areas may require priority (not excluding all other turbines) during post-construction studies, and in some instances, there is a higher likelihood that mitigation measures may need to be applied to them.	Allowed inside these areas.	Allowed inside these areas.	Allowed inside these areas.
Moderate Sensitivity buffer	Turbines within these areas may require priority (not excluding all other turbines) during post-construction studies, and in some instances, there is a higher likelihood that mitigation measures may need to be applied to them.	Allowed inside these areas.	Allowed inside these areas.	Allowed inside these areas.

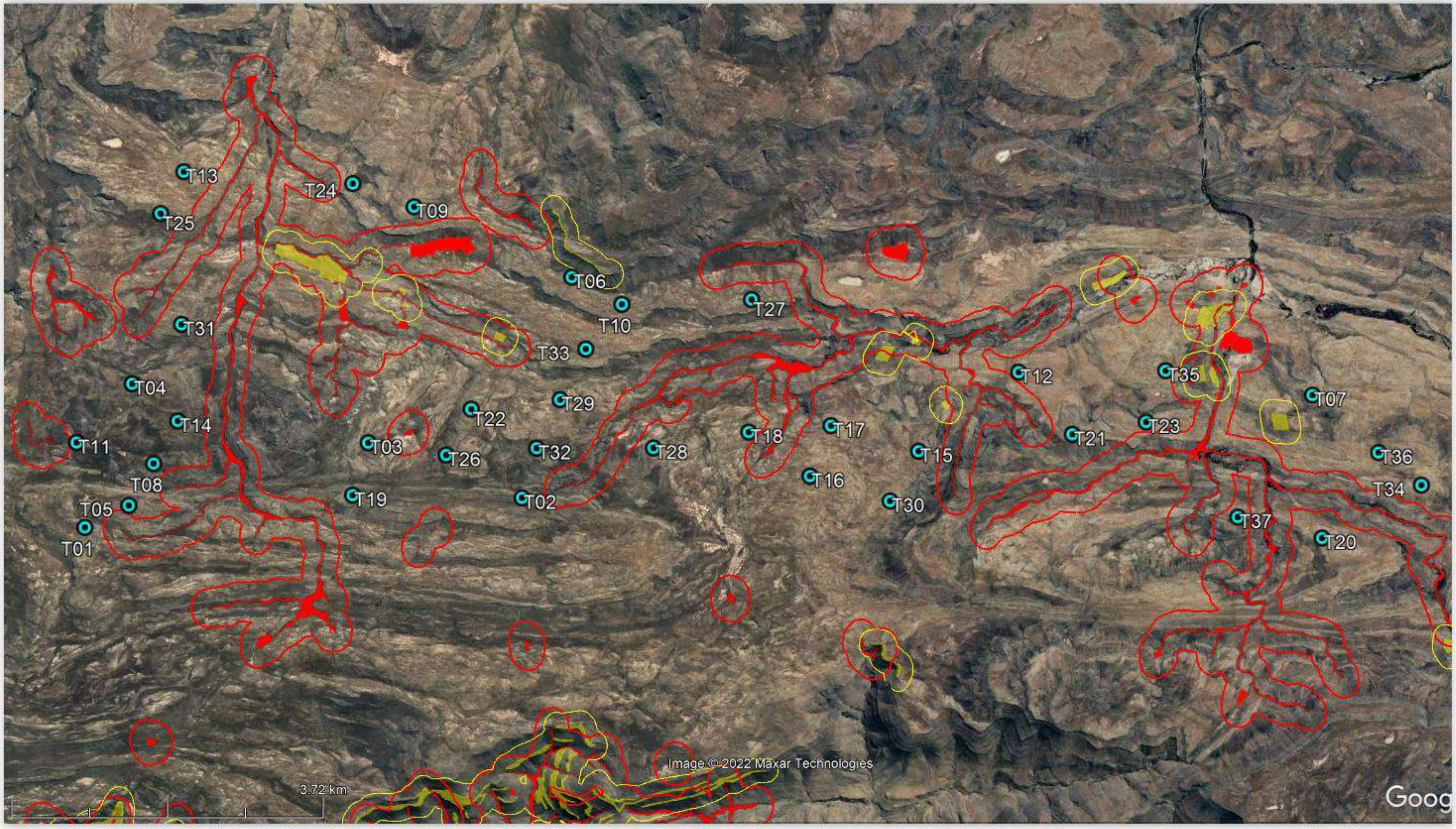

Figure 2.1: Micro-sited turbine layout in relation to the revised bat sensitivity map. Shaded red = High bat sensitivity; Red line = 200m high bat sensitivity buffer; Shaded yellow = Moderate bat sensitivity; Yellow line = 150m moderate bat sensitivity buffer.

3 MITIGATION OPTIONS PERTAINING TO THE EMPr

This Mitigation Action Plan must be included into the EMPr in its entirety, and must also be referred to in the conditions of Environmental Authorisation (EA) and be implemented immediately once the WEF becomes operational. Note that some mitigations to minimise light pollution or requirements like the appointment of a specialist for a bat mortality study, must be initiated before the commercial operational date of the WEF.

The bat specialist conducting the operational bat monitoring may overwrite applicable sections of this mitigation plan, but only when robust and more applicable bat activity and climate data are available for specific problematic turbines or areas of the site.

The available options to minimise bat mortalities are discussed in this section. Details on if, when or how each option must be implemented is explained in the step-by-step Mitigation Action Plan in Section 4.

3.1 Minimisation of light pollution and artificial habitat creation

A mitigation to consider in the design of the WEF is to keep artificial lighting to a minimum on the infrastructure (O&M buildings and on wind turbines), while still adhering to safety and security requirements. For example, this can be achieved by having floodlights down-hooded, installing passive motion sensors onto lights around buildings and possibly utilising lights with lighting colours (also referred to as lighting temperatures) that attract fewer insects. Light pollution will impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights.

Stormwater management should also avoid creating artificial wetlands and open water sources in the turbine zones (closer than 286m from any turbine base), as this will increase insect and bat activity around turbines.

The likelihood of bats being killed by moving turbine blades increases significantly when they are attracted to their proximity, when it has become an improved foraging airspace due to the presence of artificial light or artificial water sources.

3.2 Curtailment to prevent freewheeling

Freewheeling occurs when the turbine blades are rotating in wind speeds below the generator cut-in speed (also called the **manufacturer's cut-in speed**), thus no electricity is being produced and only some blade momentum is maintained.

Since bat activity tends to be negatively correlated with wind speed, it means that high numbers of bats are likely to be flying and impacted on in low wind speeds where freewheeling may occur. If turbine blades are feathered below the generator cut-in speed to prevent freewheeling, it can result in a very significant reduction of bat mortalities with minimal energy production loss.

3.3 Curtailment that increases the cut-in speed

The activity levels of South African bats generally decrease in weather conditions with increased wind speeds. However, in scenarios where above sustainable numbers of bats are being killed, and these bats fly in wind speeds above the turbine manufacturer's cut-in speed, the turbine's computer control system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) can be programmed to a cut-in speed higher than the manufacturer's set speed. The new cut-in speed will then be referred to as the **mitigation cut-in speed** and can be determined from studying the relationship between long term (12-month) bat activity patterns on site and wind speed. This sustainable threshold of bat mortalities will be calculated according to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018).

Turbines may be curtailed in this manner by means of blade feathering, to render the blades motionless in wind speeds below the mitigation cut-in speed.

3.4 Acoustic bat deterrents

This technology is developed well enough to be tested on site and may be recommended during operational monitoring, if mortality data indicate bat mortalities above the sustainable threshold for the WEF. This threshold will be calculated according to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018). Initial experiments with this technology on WEFs in South Africa are yielding positive results that may indicate the effectiveness of the devices, but in the correct scenarios for certain species.

Current data on the South African trials is still limited to a small sample set, and the technology will not necessarily be effective in all mitigation scenarios and for all bat species. Therefore, it should be considered and tested on a case-by-case basis if possible, and it is highly recommended that adequate monitoring continues concurrently, to assess the effectiveness of the devices in reducing bat mortalities.

4 MITIGATION ACTION PLAN FOR INCLUSION INTO THE EMPr

It is important to note that this Mitigation Action Plan replaces all previously recommended mitigation measures on the Rietrug WEF project.

4.1 Step 1: Minimisation of light pollution and artificial habitat creation (refer to Section 3.1)

During the planning phase for the WEF, it must become mandatory to only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools, where practically possible, without compromising security requirements. This applies to the turbine bases (if applicable) and other infrastructure/buildings. Aviation lights should remain as required by aviation regulations. Floodlights should be down-hooded and where possible, lights with a colour (lighting temperature) that attract less insects should be used. This mitigation step is a simple and cost-effective strategy to effectively decrease the chances of bat mortality on site.

Bi-annual visits to the facility at night must be conducted for the operational lifetime of the facility by operational staff of the facility, to assess the lighting setup and whether the passive motion sensors are functioning correctly. The bat specialist conducting the operational bat mortality monitoring must conduct at least one visit to site during nighttime, to assess the placement and setup of outside lights on the facility. When lights are replaced and maintenance on lights is conducted, this Mitigation Action Plan must be consulted.

The storm water drainage plan must avoid creations of artificial ponds/open water sources or wetlands in turbine zones (less than 286m from any turbine base), as these will increase insect activity and therefore bat activity in the area. This can result in turbines that were previously assessed as having a low risk to be financially and biologically costly high-risk turbines.

4.2 Step 2: Appointment of bat specialist to conduct operational bat mortality monitoring

As soon as the WEF becomes operational, a bat specialist must start to conduct a minimum of 2 years of operational bat mortality monitoring. This specialist must be appointed before the facility becomes operational, so the operational monitoring can start at the same time as the commercial operation date of the facility. The methodology of this monitoring must comply with the *South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities - 2nd Edition June 2020* (Aronson *et al.* 2020), or any newer version of the applicable guidelines that may be in force at the start of operation of the facility.

The results of the bat mortality study may be used to develop mitigation measures focused on specific problematic turbines. The results of the operational monitoring must be made available, on request, to other bat specialists conducting operational and pre-construction monitoring on WEFs in South Africa.

4.3 Step 3: Curtailment to prevent freewheeling (refer to Section 3.2)

Based on high bat activity detected during the 12-month pre-construction study, from 1 November to 30 April every night for the lifetime of the facility, curtailment must be applied to all turbines by ninety-degree feathering of blades below the **manufacturer's cut-in speed**, so it is exactly parallel to the wind direction and minimises freewheeling blade rotation as much as possible without locking the blades. This can significantly lower probability of bat mortalities. Influence on productivity is minimal since no power is generated below the manufacture's cut-in speed.

4.4 Step 4: Additional mitigation by curtailment or acoustic deterrents (refer to Sections 3.3 and 3.4)

If mitigation steps 1 – 3 are followed, and the bat mortality monitoring study detects bat mortalities that are above the sustainable threshold for the WEF, then additional mitigation will need to be implemented to bring bat mortalities to or below the sustainable threshold. According to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018), this threshold is calculated by considering the hectare size of the WEF area of turbine influence and the value of 2% of bats/10ha/year for the ecoregions that the WEF is located in, to give an annual number of sustainable bat mortalities that is acceptable for the WEF. The area of turbine influence of a WEF is dictated by the turbine layout and is a tight fitting polygon around the turbine layout (**Figure 4-1**). The site falls over three vegetation units (Olson *et al.*, 2012), namely the Succulent Karoo in the north-west and the Montane Fynbos and Renosterveld in the middle and south, and Nama Karoo on the far east. In this version of the threshold guidelines, the acceptable sustainable threshold is calculated as 0.04 bats/10ha/annum for the Succulent Karoo and 0.08 bats/10ha/annum Montane Fynbos and Renosterveld, and 0.2 bats/10ha/annum for the Nama Karoo. The calculated annual acceptable sustainable threshold of bat mortalities for the total WEF is indicated in


Image © 2022 Maxar Technologies
3.68 km
Goog

Figure 4-1: The turbine area of influence used to calculate the area applicable to the acceptable bat mortality thresholds.

Table 4.1 below. The threshold is based on values adjusted for biases such as searcher efficiency and carcass persistence. Note that a newer version of the Threshold Guidelines or another similar applicable document may be adopted during the operation of the WEF.

Figure 4-1: The turbine area of influence used to calculate the area applicable to the acceptable bat mortality thresholds.

Table 4.1: The sustainable acceptable mortality thresholds of the authorised Rietrug WEF.

	Area of influence of wind turbines (hectares)	**Acceptable annual mortality of bats (adjusted values for biases such as searcher efficiency and carcass persistence)**
Rietrug WEF (Succulent Karoo veg unit)	1 283	0.04 x (1283/10) = 0.04 x 128.3 = **5 bats**
Rietrug WEF (Montane Fynbos and Renosterveld veg unit)	2 343	0.08 x (2343/10) = 0.08 x 234.3 = **19 bats**
Rietrug WEF (Nama Karoo veg unit)	114	0.2 x (114/10) = 0.2 x 11.4 = **23 bats**
Total for both veg units		5 + 19 + 23 = **47 bats**

Such additional mitigation measures may be to curtail problematic turbines according to the **mitigation cut-in speed** (Section 3.3), and/or to utilise acoustic deterrents on problematic turbines (Section 3.4). If the turbine layout is amended, the calculation in **Table 4.1** needs to be revised.

Preliminarily, it is advised that any additional mitigation measures that may be required be applied during 1 November to 30 April, and must be applied to any turbines or group of turbines identified as causing the WEF's mortalities to be above the sustainable threshold levels. This time period is based on high bat activity months as detected during the 12-month pre-construction study.

The bat specialist conducting the operational bat monitoring may recommend other time periods for additional mitigation, based on robust mortality data. If required, the bat specialist may make use of new climatic or acoustic data to allow for an active and adaptable mitigation schedule.

4.5 Step 5: Auditing of bat mortalities for the lifetime of the facility

During the implementation of mitigation Steps 1 – 4, it is crucial for the facility to determine and monitor bat mortalities in order to implement, maintain and adapt mitigations as efficiently as possible. For the duration of the lifetime of the facility, the impacts on bats must be audited/monitored by reliable methods of carcass searching and/or electronic devices capable of automatically counting bat mortalities. Such auditing should occur every 5 years (after the end of the initial 2-year operational study) for all turbines on site.

5 CONCLUSION

The proposed microsited turbine layout respects the bat sensitivity map, and no turbines blades are intruding into any high bat sensitivities or their associated buffer areas.

Animalia has **no objection to the proposed microsited final turbine layout**, on condition that this mitigation action plan is incorporated into the EMPr and is adhered to.