PART 2 AMENDMENT REPORT FOR BATS
POORTJIES WIND ENERGY FACILITY
NORTHERN CAPE, SOUTH AFRICA

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1 INTRODUCTION

This report forms part of the application for a Part 2 amendment to change the turbine specifications at the Poortjies Wind Energy Facility (WEF) located near Pofadder, South Africa (Table 1). The project is being developed by South Africa Mainstream Renewable Power Developments (Pty) Ltd ("Mainstream") who received an Environmental Authorisation (EA) in May 2015.

Table 1: Proposed Amendments to the Poortjies WEF

Component	Approved	Proposed Amendments
Rotor diameter	140 m	Up to 200 m
Hub Height	140 m	Up to 200 m
Number of Turbines	50	24

As per the EIA requirements for Part 2 amendments, this report has been structured to include the following:

1. An assessment of all impacts related to the proposed changes, including a comparison with those impacts predicted in the EIA[1]
2. Advantages and disadvantages associated with the proposed change
3. Measures to ensure avoidance, management and mitigation of impacts associated with the proposed change
4. Any changes to the EMPr

2 ASSUMPTIONS AND LIMITATIONS

The relationship between bat fatality and both turbine and wind farm size is equivocal making it challenging to assess the impact of changes to turbine and wind farm size on risk to bats. For example, in the United Kingdom[2] risk to bats appears to increase with the number of turbines but not in the United States[3]. These differences could be related to the varying ecologies of the respective bat communities (e.g., in the United States migratory bat species comprise most fatalities), due to varying wind farm characteristics, or due to differences in how studies estimated fatality and accounted for study biases[4]. This suggests that assessments should be relevant to local bat species as much as possible. Limited published data are available on the relationship between turbine and wind farm size and bat fatality in South African. This report is therefore based on unpublished local data and the specialist's local knowledge and experience, supplemented with findings from international research.

To assess the impact of the proposed amendment, it is assumed that the hub height and rotor diameter of the turbines ultimately selected will range between 140 m (approved) and 200 m (proposed), and that any combination of hub height and rotor diameter between these lower and upper bounds could be used. However, turbines within these bounds may have differential impacts to bats since bat fatality varies with turbine size. Therefore, the worst-case scenario is assessed, assuming that the worst-case would be the turbine with blades sweeping the closest to the ground. The rationale for this assumption is that bat activity recorded at the met mast during the pre-construction monitoring was higher at the lower microphone (12 m) compared to the

[1] Arcus Consultancy Service (2014). Pre-construction bat monitoring and impact assessment, Pofadder wind energy facility, Northern Cape. Final EIA report.
[2] Mathews, F., Richardson, S., Lintott, P., & Hosken, D. (2016). Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management. Report by University of Exeter. pp 127.
[3] Thompson, M., J. A. Beston, M. Etterson, J. E. Diffendorfer, and S. R. Loss. 2017. Factors associated with bat mortality at wind energy facilities in the United States. Biological Conservation 215:241-245.
[4] Smallwood, K. S. 2020. USA Wind Energy-Caused Bat Fatalities Increase with Shorter Fatality Search Intervals. Diversity 2000.

upper microphone (65 m). This aligns with data from other arid regions in South Africa[5]. Thus, turbine blade tips extending into lower airspaces might increase risk to bats. The worst-case scenario (defined as a turbine with the lowest hub height and longest blades) would be a turbine with a hub height of 140 m and a rotor diameter of 200 m which would result in the blades extending down to 40 m above the ground.

3 ADVANTAGES AND DISADVANTAGES

An advantage of the proposed amendments is the reduction in the number of turbines from 50 to 24. The hypothesis is that by using fewer turbine, bats will be less likely to encounter a given wind turbine and hence overall fatality should decrease. However, evidence from the United Kingdom[6] suggests that while the risk to bats increases with the number of turbines, risk also increases with larger rotor sizes, with each additional increase in blade length predicted to increase mortality by 18 % per metre. Thus, reducing the number of turbines might not automatically reduce risk especially if larger turbines are used instead. Published evidence from Germany[7] and the United States[2], and unpublished data from South Africa, suggests that for some bat species, the number of turbines at a wind farm does not influence risk. Nonetheless, because of this uncertainty, it is assumed that having fewer turbines would present a potential advantage of the amendments.

Following from the above, a disadvantage of the proposed amendments is the larger rotor diameter which will create a larger rotor swept area (RSA) hence increasing the probability that a bat could encounter risky airspace. The blade tips would also extend closer to the ground and reach higher up into the air. Currently the RSA extends from 70 m above ground level up to 210 m. Based on the worst-case scenario, this would change to 40 m above ground level up to 240 m. This change may increase risk to bats compared to the previous impact assessment and is therefore a disadvantage of the proposed amendments.

The increased hub height may be an advantage of this amendment because it facilitates elevating the rotor blades further from ground level where risk to bats is lower. However, this would be counteracted with increases to the blade length especially if these extend closer to ground level as in the worst-case scenario. Based on unpublished data from South Africa the minimum blade sweep is an important factor to consider when assessing risk, with risk increasing with decreases in the minimum blade sweep height. The advantage of the increased hub height may therefore only be realised in conjunction with relatively shorter blades that avoid lower, riskier airspaces.

4 ASSESSMENT OF IMPACTS

This report evaluates to what degree the proposed amendments change the predicated impacts to bats assessed during the EIA in December 2014[1]. Direct impacts considered during the original EIA were roost destruction, roost disturbance and bat mortality (during commuting/foraging or migration). Indirect impacts were habitat modification, light pollution, habitat creation in high-risk areas, light pollution, and loss of ecosystem services. Since bat mortality during commuting/foraging poses the major direct impact associated with the proposed Poortjies WEF, only this impact is assessed in this report. All other identified impacts are unlikely to be affected by the proposed changes. The original EIA predicted risk of bat mortality during commuting/foraging to have a medium significance (Table 2). The worst-case scenario would increase risk to bats

[5] MacEwan, K. L., T. W. Morgan, C. A. Lötter, and A. T. Tredennick. 2020. Bat Activity Across South Africa: Implications for Wind Energy Development. African Journal of Wildlife Research 50.
[6] Mathews, F., Richardson, S., Lintott, P., & Hosken, D. (2016). Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management. Report by University of Exeter. pp 127.
[7] Rydell, J., L. Bach, M.-J. Dubourg-Savage, M. Green, L. Rodrigues, and A. Hedenström. 2010. Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12:261-274.

(Table 3), but the overall significance of the impact would remain medium with mitigation based on the amendments.

Table 2: Original Impact Assessment for Bat Mortality during commuting/foraging (2014)

Nature: Mortality due to collisions with wind turbine blades and/or barotrauma during commuting and/or foraging.		
	Without mitigation	***With mitigation***
Extent	Regional (3)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (8)	Low (5)
Probability	Highly probable (4)	Probable (3)
Significance	**56 (Medium)**	**33 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Impossible	Impossible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: There are several mitigation options available to reduce the potential for bat mortality to occur or to reduce bat mortality if it does occur beyond acceptable levels. Designing the layout of the Development to avoid areas that bats may potentially be using may reduce the likelihood of mortality. A buffer of 300 m and 500 m (depending on the type of roost) should be applied around potential roosts in the Development site. Operational acoustic monitoring and carcass searches for bats should be performed to monitor mortality levels. If mortality does occur mitigation options include using ultrasonic deterrents, raising the cut-in speeds of turbines, turbine blade feathering and using targeted curtailment during specific seasons and time periods for specific turbines.		
Cumulative impacts: The cumulative impacts will depend on the number of WEFs in the region, the species involved and the levels of bat mortality. Bats reproduce slowly (Barclay & Harder 2003) and their populations can take long periods of time to recover from disturbances so the cumulative impacts can be high if appropriate management and mitigation is not implemented. With appropriate mitigation the cumulative impacts can be low.		
Residual Impacts: The level of residual impacts will depend on the specific mitigation applied but it is likely that there will some bat mortality even with mitigation during the lifespan of the Development. If this is not carefully managed this could impact resident bat species and/or wider populations for migratory species. Knowledge of the status of bat populations in South Africa is poor and the residual impacts could be high and long lasting.		

Table 3: Updated Impact Assessment for Bat Mortality during commuting/foraging (2021)

Nature: Mortality due to collisions with wind turbine blades and/or barotrauma during commuting and/or foraging.		
	Without mitigation	***With mitigation***
Extent	Regional (3)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (7)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**56 (Medium)**	**36 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Impossible	Impossible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: same as Table 2		
Cumulative impacts: same as Table 2		
Residual Impacts: same as Table 2		

5 MITIGATION OF IMPACTS

The current mitigation measures include using buffers to spatially segregate areas important for bats from wind turbines. At the proposed site, these areas are potential bat roosts that were identified, mapped, and buffered during the pre-construction monitoring[1]. The remaining mitigation measures are implemented during the operation of the facility and include using, if fatality occurs, ultrasonic deterrents, raising the cut-in speeds of turbines, turbine blade feathering and using targeted curtailment. The proposed amendments do not require the implementation of any additional mitigation measures. Therefore, the mitigation measures described in the pre-construction bat monitoring report and Final EIA report must be adhered to.

6 CHANGES TO THE EMPR

The mitigation measures described above must be implemented according to the Environmental Management Programme in the pre-construction monitoring report[1]. The basis of this plan is to implement a programme to search for bat carcasses and depending on the magnitude of bat mortality, several adaptive management actions must be used (Table 4). No additional management actions would be required based on the amendment however Objective 3 of Chapter 7 in Draft EMP[8] must be updated to reflect that in the bat impact assessment report[1].

[8] Savannah Environmental (2015). Proposed Poortjies Wind Energy Facility project, located near Pofadder in the Northern Cape Province, Draft Environmental Management Programme.

Table 4: Environmental Management Programme for Bat Mortality during commuting/foraging (2014)

Objective: Reduction in bat mortality if mortality occurs beyond acceptable levels.			
Project component/s	The operational activities of the Development.		
Potential Impact	Without effective mitigation, the potential impact is the possible decline over time in the populations of affected species and possible ecosystem level consequences depending on the severity of the impacts.		
Activity/risk source	The operational activities of the Development and non-compliance with the Environmental Management Programme will have a direct impact on meeting this objective.		
Mitigation: Target/Objective	Reduction in bat mortality to a level to be determined by a suitably qualified bat specialist after consideration of pre-construction monitoring data, mortality data from operational monitoring at the Development and any relevant guidance available at the time.		
Mitigation Action/Control		**Responsibility**	**Timeframe**
An operational monitoring study to search for bat carcasses (and to record bats using acoustic monitoring, especially at height) must be implemented. This should be undertaken according to the Best Practice Guidelines for bats available at the time.		Developer/WEF operator and suitably qualified bat specialist.	According to best practice (i.e., when turbine blades begin spinning and for two years).
If, according to a suitably qualified bat specialist and available guidance, levels of mortality are unacceptable, the following actions apply: Extending the operational monitoring study. Testing and using ultrasonic deterrent devices to prevent bats entering the airspace of the Development. Turbine blade feathering to reduce the rotation of turbine blades below the candidate turbine cut-in speed, without increasing the cut-in speed. Increasing the cut-in speed of turbines contributing to mortality (as shown by operational bat monitoring data) to wind speeds when the majority of bat species are not active. For example, approximately 60% of the bat activity in summer occurred below 6 m/s. The determination of these exact wind speeds will require detailed analysis of the pre-construction and operational acoustic monitoring data and must be discussed with the WEF operator. Applying curtailment to turbines contributing to mortality (as shown by operational bat monitoring data) during specific time period and seasons. For example, reducing turbine operation when bats are most active (e.g., between 20:00 and 22:00 in January, February and December). The above approaches should be used in an adaptive manner, adjusting the degree of mitigation (i.e., curtailment) applied based on mortality data and the success/failure of each type of mitigation. These mitigation measures should not be implemented without first consulting a bat specialist.		Developer/WEF operator.	Duration of operational phase.
Performance Indicator	A reduction in bat fatalities to acceptable levels (based on specialist expertise and available guidance) as a result of mitigation is the major performance indicator.		
Monitoring	The analysis of bat fatality data should be undertaken regularly (i.e., as data are collected) by a suitably qualified bat specialist to determine the levels of bat mortality and to ensure this objective is met. The operational mitigation plan should be continuously reviewed based on the results.		

7 CONCLUSION

Mainstream propose to reduce the number of turbines at the Poortjies WEF and to increase the hub height and rotor diameter to up to 200 m respectively. These amendments would increase the magnitude of impact to bats but overall, the significance of this impact remains as medium provided mitigation measures are implemented. A management plan was created in 2014[1] and this must be included in the updated EMPr and refined on an on-going basis using adaptive management in response to the level of bat mortality experience during the operation of the wind farm.