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Verification of the authorised Brandvalley wind energy facility (WEF) turbine layout, in relation to the bat sensitivity map and impacts on bats.

Animalia Consultants (Pty) Ltd) completed the 12 months pre-construction bat monitoring for the Brandvalley Wind Energy Facility (WEF). The final preconstruction bat impact report also served as the EIA phase bat report and was submitted in July 2016. It included the assessments of impacts as required for the EIA phase.

The applicant is proposing a hub height of 125m and a rotor diameter of 180m. The assessment of the turbine layout, bat sensitivity map and on-site verification, in relation to impacts on bats, considers this proposed dimension and layout amendment.

A site visit was conducted on 13 September 2021 by Animalia Consultants (Pty) Ltd to verify the turbine layout in relation to the approved bat sensitivity map. The proposed turbine layout respects the bat sensitivity map as was applicable during the preconstruction guidelines that was in use during the EIA assessment and subsequent amendments (**Figure 1**). It also respects the current guideline criteria which requires turbine blade length to be outside the high sensitivity buffers, except for Turbines B20, B32, B49, B53, B58.

According to the passive bat activity data collected on site during the preconstruction study, bat activity at 50m height was significantly less than activity at a lower altitude of 10m. Except in the case of the Barendskraal NW meteorological mast where the *Tadarida aegyptiaca* species (Egyptian Free-tailed bat) had higher abundances at 50m. The *Tadarida aegyptiaca* (Egyptian Free-tailed) bat which dominated the occurrence on site, also have the highest likelihood of being impacted on by wind turbines. However, the decrease in the lowest rotor swept height is not significant enough to influence the assessments of the impacts as identified in the EIA phase bat assessment report. But it should be noted that the larger rotor diameter effectively brings the impact zone of each turbine closer to all bat sensitivity buffers, and no part of the turbine (including the turbine blades) is allowed to intrude into high bat sensitivity buffers.

The sensitivity map for the Brandvalley Wind Farm site was updated in October 2018. This update predominantly consisted of the delineation of watercourses within of the Brandvalley project area, using the open source SAGA GIS tool. This tool uses the topography of the area based on a 5m digital elevation model to calculate the channel flow. The tool first fills the sinks. A sink is a cell or set of spatially connected cells whose flow direction cannot be assigned one of the eight valid values in a flow direction raster. This can occur when all neighbouring cells are higher than the processing cell or when two cells flow into each other, creating a two-cell loop. To create an accurate representation of flow direction and, therefore, accumulated flow, it is best to use a dataset that is free of sinks. A digital elevation model (DEM) that has been processed to remove all sinks

is called a depressionless DEM. Next, the flow accumulation is calculated meaning how much water can accumulate in one cell (in m3). Thresholds of 50k, 75k and 100k were considered and 75k was determined to be the most accurate threshold with the least amount of data 'noise' (**Figure 1**).

On a flat surface the distance from a high sensitivity must be 200m, which constitutes the high sensitivity buffer. This includes all parts of a turbine such as the turbine blades, and is in line with the MacEwan, et al. (2020) Preconstruction Guidelines. Therefore, based on a rotor diameter of 180m (blade length of 90m), the turbine base position must be 290m or more from any high bat sensitivities and 90m from high sensitivity buffers. However, in this case the actual bat sensitivities are at a lower elevation in valleys and the turbines are proposed on the ridges. In cases where the turbine base was closer than 90m to the high sensitivity buffer, a formula was applied to consider the hub height of 125m, 90m blade length and difference in elevation of turbine base and sensitivity. In order to calculate the distance of the base to the buffer required for maintaining a minimum of 200m from a blade tip to an actual sensitivity. This formula was only required for Turbines B20, B32, B49, B53 and B58 since their blades are intruding into the high bat sensitivity buffers.

Formula used: b=√((200+bl)2 -(hh+ed)2), derived from Mitchell-Jones & Carlin (2009).

Where:

b= horizontal distance required from turbine base to high sensitivity buffer

bl = blade length

hh= hub height

ed= elevation difference between turbine base and actual sensitivity

When considering a 90m blade length, based on above calculation considering the difference in elevation between the bat sensitivity and the turbine base position, Turbines B20, B32, B49, B53 and B58 base centre points should be moved to be outside of the high bat sensitivity buffer. All other turbines proposed can remain in the currently authorised positions. The significance ratings of the original impacts identified will not change as a result of the amendments.

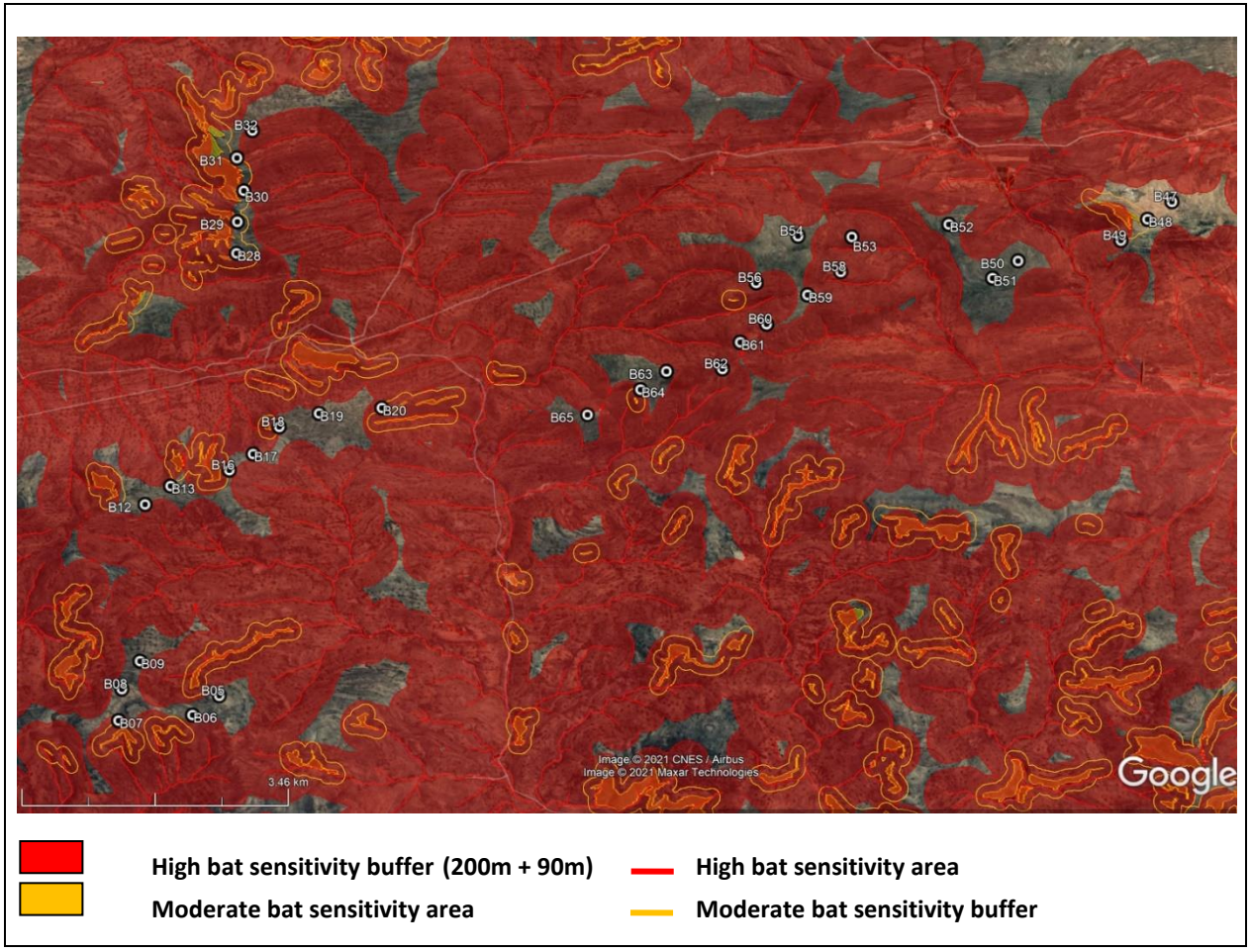

Figure 1: Bat sensitivity map of the Rietkloof site with proposed turbine layout.

In summary, the proposed layout is acceptable from a bat sensitivity perspective if all conditions of the EA are adhered to, an operational bat impact monitoring study is conducted for a minimum of 2 years, and Turbines B20, B32, B49, B53 and B58 are moved outside of the high bat sensitivity buffer.

If there are any queries, please do not hesitate to contact me.

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