# SiVEST SA (PTY) LTD

## FINAL BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE PATATSKLOOF WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, NEAR CERES, WESTERN CAPE PROVINCE, SOUTH AFRICA

### Final Report: Bat Monitoring at the Patatskloof Wind Energy Facility, Western Cape

| | |
|---|---|
| **DFFE Reference**: | TBA |
| **Report Prepared by:** | **Stephanie Dippenaar Consulting trading as EkoVler** |
| **Issue Date:** | September 2022 |
| **Version No.:** | 1 |

# EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as “Mainstream”) has appointed SiVEST SA (Pty) Ltd (hereafter referred to as “SiVEST”) to undertake the required Basic Assessment (BA) process for the proposed 250 megawatt (MW) Patatskloof Wind Energy Facility (WEF) and associated grid infrastructure near Touws River in the Western Cape Province (hereafter referred to as the “Project”). The project site is approximately 6 612 hectares (ha) in extent and is situated within the Komsberg Wind Renewable Energy Development Zone (REDz) (namely REDz 2). The proposed Patatskloof WEF footprint however covers a smaller area of 2 905,4 ha within the overall project site.

Stephanie Dippenaar Consulting, trading as EkoVler, was appointed to undertake a 12-month pre-construction bat monitoring programme to inform the BA process. The pre-construction bat monitoring was conducted between 11 June 2021 and 27 June 2022.

Important conservation features in the vicinity include the Touw Local Nature Reserve and the Anysberg Provincial Reserve, situated respectively 10 km and 25 km, as the crow flies, from the closest border of Patatskloof WEF. The project is situated within the Succulent Karoo and regionally falls within three Bioregions, namely the Inland Saline Vegetation, the Rainshadow Valley Karoo, and the Western Fynbos-Renosterveld Bioregions.

The development area is dominated by low shrubland, predominantly “suurveld”, which is used for game and limited cattle farming. As part of the Komsberg REDz, various farms in the nearby vicinity are currently leased to developers for solar and wind energy production.

The southern part of the development is mountainous, with numerous rocky outcrops and valleys, which provide ample roosting opportunities for bats. Although most of the project site comprises typical Karoo vegetation, relatively dense vegetation occurs along some of the drainage lines, especially towards the southern section of the development site and along a deep ravine situated in the central to the eastern part of the site. These dense bushes provide roosting opportunities for those bats preferring to roost in vegetation or under the bark of trees. Non-perennial rivers, water troughs for animals, deep valleys in the ravine and farm dams provide open water sources for bats throughout the year. Standing water collected in the riverbeds during rainy spells could provide breeding grounds for insects, which serve as food for bats.

Of the 12 bat species which have distribution maps overlaying the proposed WEF, four have a conservation status of Near Threatened in South Africa and one has a status of Vulnerable, while three have a global conservation status of Near Threatened. Three bat species occurring in the area are endemic.

According to the likelihood of fatality risk, as indicated in the latest pre-construction guidelines (MacEwan, *et al*., 2020), four species have a high risk of fatality, with a further four species having a medium-high and medium risk of fatality.

Data from passive monitoring systems, transects, roost surveys and a desktop study informed this report. Five static SM4BAT systems were deployed at the project site, with three systems located near-ground and two within the sweep of the turbine blades.

Calls like five of the 12 species that have distribution maps overlaying the proposed development site were recorded by the static recorders. 81% of the bat activity recorded at the Patatskloof WEF was by *Tadarida aegyptiaca* (Egyptian free-tailed bat) which is a high-risk species, physiologically adapted to fly at high altitudes within the vicinity of the turbine blades. Due to this foraging preference, the risk of collision and barotrauma is high. Two more species, *Sauromys petrophilus* (Roberts' flat-headed bat) (10%) and *Neoromicia Capensis* (Cape serotine bat) (8%) also showed a significant presence, while 1% of the activity was for the Near Threatened species *Miniopterus natalensis* (Natal long-fingered bat) and a statistically insignificant number of the endemic species *Eptesicus hottentotus* (Long-tailed house bat). At the proposed Patatskloof WEF, the Molossidae family (namely Free-tailed bats) is more dominant at the high-altitude systems, with *S. petrophilus* and *T. aegyptiaca* comprising 91% of all the activity recorded at height (Systems A and B).

An increase in bat activity was recorded in spring (September), when warmer temperatures were experienced, with a peak in October and a second, higher peak during late summer (February). Activity declined in early autumn (March). The second most abundant species, *S. petrophilus,* mimics the activity pattern of *T. aegyptiaca,* although the activity is substantially lower than the latter. The low activity lasts up to the middle of August. In general, bat activity in the Karoo tends to increase during warmer seasons, and according to the present data, this is also the case at Patatskloof WEF.

System C, situated at a height of 12 m on the Meteorological (i.e., Met) mast in the central to the south-western part of the terrain, recorded the highest bat activity. High activity was also recorded at the other two near-ground systems, G and H. Within the sweep of the turbine blades, System B at a height of 55 m, recorded higher activity in comparison to System A at a height of 105 m. One would therefore suspect that the highest mortality may be experienced in the lower region of the turbine sweep.

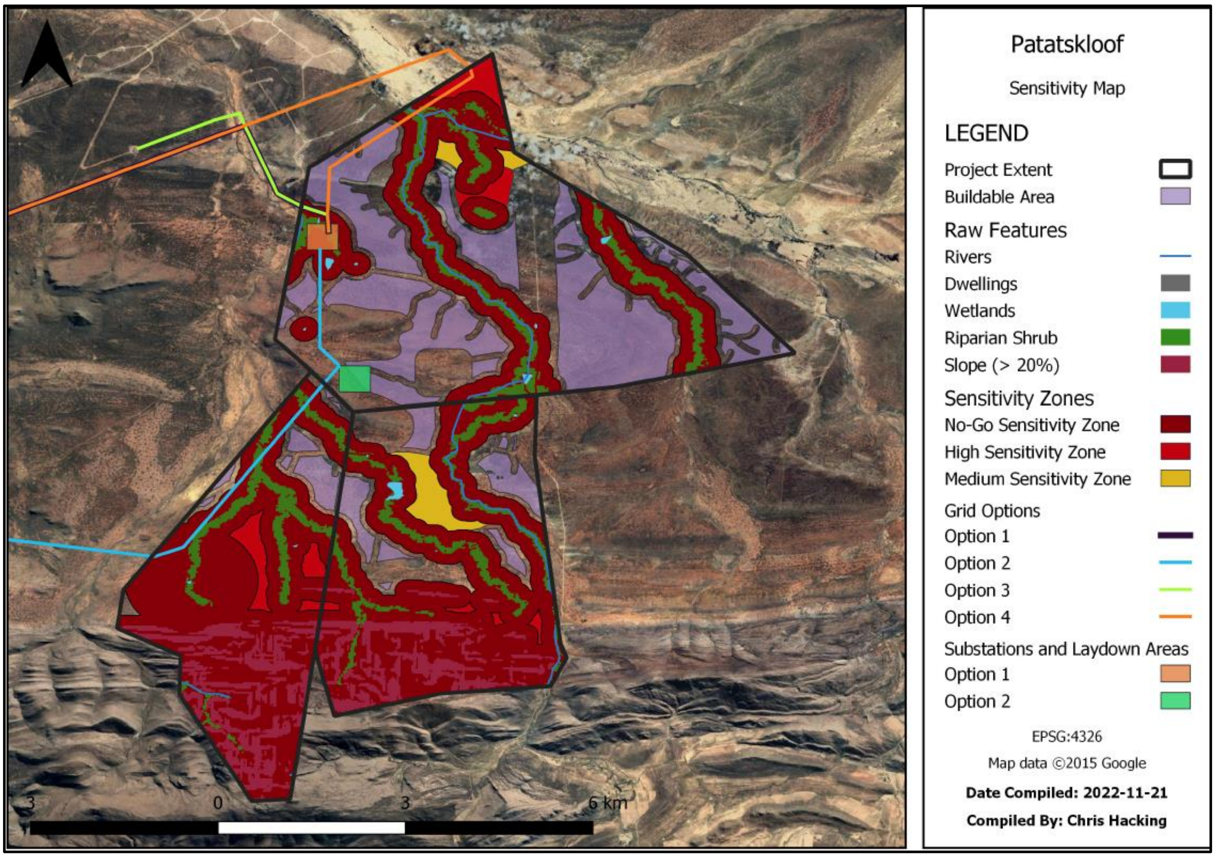
In general, all the monitoring systems show a sharp increase in activity approximately two to three hours after sunset. Although there are differences in the peak hours of the various systems, all the systems follow the same trend, with an increase in activity after sunset, peak activity between approximately 21:00 and 0:00, followed by a gradual decline in activity up to two to three hours before sunrise.

According to the South African Bat Threshold Guidelines (MacEwan *et al*., 2018), bat activity at near ground level, as well as within the rotor sweep area, falls in the highest risk category, with a combined hourly bat activity median of 0,83 near-ground and 0,40 in the rotor sweep. This is not regarded as a fatal flaw, but rather a confirmation of the recommended fatality minimisation measures for implementation during the operational phase (section 9 of the main report).

Data from the high systems A and B on the Met mast were statistically analysed for correlations between weather conditions and bat activity. Optimal conditions for bat activity on the terrain include temperatures above 15 ℃, wind speeds below 10 m/s and humidity levels between 40% and 70%.

Transect surveys showed a high number of 80 bat passes during the springtime (November), and 64 bat passes during an extra section driven in the southern section of the site, indicating that there are some nights, with optimal weather conditions and possible high insect occurrence, when bat activity is high. A transect conducted at the beginning of September, when the weather was still cold, recorded only one bat, confirming the low activity portrayed by the stationary systems during colder weather conditions.

A bat sensitivity map classified no-go, high and medium sensitivity zones (see below). It is recommended that no operating turbine components are allowed in the no-go and high sensitivity areas, whereas medium sensitivity zones could be developed with mitigation. Supporting infrastructures, such as the laydown area, site substation and Battery Energy Storage System (BESS) may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any possible bat roosts, as per the Environmental Management Programme (EMPr).




***Bat sensitivity map***

It is recommended that curtailment is applied in medium sensitivity zones during the time periods when a specific combination of temperature, wind speed and humidity prevail. Mitigation for specific turbines will need to be refined during the operational phase, using the below table as a starting point for such discussions:

| MITIGATION FOR TURBINES SITUATED IN MEDIUM SENSITIVITY ZONES | | | | | |
|---|---|---|---|---|---|
| *Months* | *Time period* | *Temperature (°C)* | *Wind speed (m/s)* | *Humidity (%)* | *Curtailment* |
| Beginning October to middle March | 2 hours after sunset, up to 7 hours before sunrise | Above 15 °C | Below 10 m/s | Between 40% and 70% humidity | Raise cut-in speed to 7 m/s |

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Medium Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Succulent Karoo, is high and the negative impact on bats during the operational phase could thus be high. This must be confirmed during operational bat monitoring, but the developer should prepare for turbine specific curtailment and/or installing bat deterrents when more information is available.

| Summary of impacts on bats from the Patatskloof WEF according to the SiVEST impact significance rating | | |
|---|---|---|
| *Phase* | *Impact before mitigation (negative)* | *Impact after mitigation (negative)* |
| Construction | 29 (5-23) Medium | 16 (5-23) Low |
| Operation | 38 (24-42) Medium | 29 (24-42) Medium |
| Decommissioning | 16 (5-23) Low | 7 (5-23) Low |
| Cumulative | 63 (62-80) Very High | 43 (43-61) High |
| Combined for the site | 36 (24-42) Medium | 24 (24-42) Medium |

As expected in an area where several back-to-back wind farms are developed, cumulative impacts on bat populations before mitigation are predicted to be High Negative, specifically when the threshold for bats in the Succulent Karoo is considered. Even with mitigation measures, the cumulative impact is expected to be High Negative. This has been confirmed by the general estimated mortality (GenEst) through carcass searches on operating wind farms in the Succulent Karoo. Despite the negative cumulative impact, this is not considered to be a fatal flaw if all the wind farms apply appropriate mitigation measures.

It is recommended that the following mitigation measures be included in the Environmental Authorisation (EA):

- The final layout must be informed by the sensitivity map provided in Section 7 of the main report, and turbine positions must avoid no-go and high sensitivity zones.
- A bat specialist must be appointed before the commercial operation date (COD).
- A mitigation scheme, as per Section 9 in the main report, must apply to operational turbines from the start, after turbines have been tested and have started to turn.
- Turbines must be feathered below cut-in speed, and although they need not be at a complete standstill, there should be minimum movement so that bats are not at risk when turbines are not generating power.
- All newly built structures that have bat conducive features must be rehabilitated to discourage bat presence. This includes roofs of new buildings, open quarries and borrow pits.
- A minimum of two year's operational bat monitoring must be conducted after commencement of operations at the WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

It should be noted that one year of pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Succulent Karoo environment is subject to erratic weather conditions, which vary from year to year. These changes usually result in changes in the bat situation which might not have been observed in this survey. This is not a limitation which would greatly affect the results of this bat monitoring programme, especially seen in the light of relatively good rainfall during the monitoring period.

The overall potential negative impact of the proposed Patatskloof WEF on bats, combined for all the development phases, is predicted to be Medium Negative without mitigation. The combined impact remains overall Medium Negative with mitigation, but the significance rating is lower.

**Based on the findings of the one-year pre-construction monitoring undertaken at the proposed Patatskloof WEF project site, the bat specialist is of the opinion that no fatal flaws exist which would prevent the construction and operation of the WEF. EA may thus be granted, subject to the implementation of the recommendations made in this report.**

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**NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)**

| Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6 | Section of Report |
|---|---|
| 1. (1) A specialist report prepared in terms of these Regulations must contain-<br>a) details of-<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | Section 1.2. |
| b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Appendix 4. |
| c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1. |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 1 and 6.1. |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 6.2. |
| d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 6.1. |
| e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 1.3. |
| f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Sections 3.3., 6, 7. |
| g) an identification of any areas to be avoided, including buffers; | Section 7. |
| h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section 7. |
| i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 2. |

| | |
|---|---|
| j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities; | Section 10. |
| k) any mitigation measures for inclusion in the EMPr; | Section 9. |
| l) any conditions for inclusion in the environmental authorisation; | Section 9. |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 9. |
| n) a reasoned opinion-<br>i. (as to) whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Section 12. |
| o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | Section 1.3. |
| p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | n.a. No comments relating to bats (including impacts) received to date. |
| q) any other information requested by the competent authority. | n.a. No specific information requested by the competent authority to date. |
| 2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | n.a. |

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## Glossary of Terms

| Definitions | |
|---|---|
| Bat monitoring systems | Ultrasonic recorders used to record bat calls |

| | |
|---|---|
| Torpor | A state of physical inactivity associated with lower body temperature and metabolism |
| SM4BAT | Wildlife Acoustics' full spectrum ultrasonic bat monitoring recorder |
| SMMU2 | Wildlife Acoustic's ultrasonic microphones for recording bat sounds |
| Threshold | Bat activity threshold as provided by SABAA |

## List of Abbreviations

| | |
|---|---|
| BA | Basic Assessment |
| BESS | Battery Energy Storage System |
| CA | National Competent Authority |
| COD | Commercial Operation Date |
| CSIR | Council of Scientific and Industrial Research |
| CDF | Cumulative Distribution Function |
| ECO | Environmental Control Officer |
| DEA | Department of Environmental Affairs |
| DFFE | Department of Forestry, Fisheries and the Environment |
| EA | Environmental Authorisation |
| EIA | Environmental Impact Assessment |
| EMPr | Environmental Management Programme |
| IPP | Independent Power Producer |
| IRP | Integrated Resource Plan |
| kV | Kilovolt (s) |
| MET | Meteorological |
| ms | milliseconds |
| MTS | Main Transmission Substation |
| MW | Megawatt(s) |
| REIPPPP | Renewable Energy Independent Power Producer Procurement Programme |
| REDz | Renewable Energy Development Zone |
| REF | Renewable Energy Facility |
| PV | Photovoltaic |
| WEF | Wind Energy Facility |
| SABAA | South African Bat Assessment Association |
| SSVR | Site Sensitivity Verification Report |

# SiVEST (PTY) LTD

# FINAL BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE PATATSKLOOF WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, NEAR TOUWS RIVER, WESTERN CAPE PROVINCE, SOUTH AFRICA

# FINAL REPORT

## 1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as “Mainstream”), has appointed SiVEST SA (Pty) Ltd (hereafter referred to as “SiVEST”) to undertake the required Basic Assessment (BA) Process for the proposed construction of the 250 MW Patatskloof Wind Energy Facility (WEF) and associated grid infrastructure near Touws River in the Western Cape Province. The Patatskloof WEF comprises an area of approximately 6 612 hectares (ha) with a smaller area of 2 905,4 ha on which the WEF will be built.

Stephanie Dippenaar Consulting, trading as EkoVler, was appointed to undertake a Bat Impact Assessment, including a 12-month pre-construction bat monitoring programme, to inform the BA process. This pre-construction bat monitoring was conducted between 11 June 2021 and 23 June 2022.

The overall objective of the development is to generate electricity by means of renewable energy technology, capturing wind energy to feed into the National Grid. It is anticipated that the proposed Patatskloof WEF will have a maximum total energy generation capacity of up to approximately 250 MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132 kV overhead power line.

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324. Such activities may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Forestry Fisheries and the Environment, (DFFE), prior to commencement. Considering this, a BA Process is being undertaken to identify and assess the impacts associated with the proposed WEF, including measures to mitigate and/or address potential impacts. Specialist studies have also been commissioned as part of the BA process to assess and verify the project under the new Gazetted specialist protocols.

This bat monitoring report comprises the following sections:

- Section 1: Introduction, which contains the Terms of Reference, Specialist Credentials and Assessment Methodology.
- Section 2: Assumptions and Limitations.
- Section 3: Technical description.
- Section 4: Legal requirement and guidelines.
- Section 5: Description of the receiving environment.
- Section 6: Specialist findings/ identification and assessment of impacts.
- Section 7: Bat sensitivity zones.
- Section 8: Cumulative Effect.
- Section 9: Proposed mitigation measures.
- Section 10: Description of the project aspects relevant to the bat impact assessment.
- Section 11: Comparative assessment of alternatives.
- Section 12: Conclusion and summary.

## 1.1 Terms of Reference

The following Terms of Reference (ToR) apply to the bat monitoring on the project site, as informed by the current pre-construction guidelines, i.e. *The South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – Pre-Construction* (MacEwan *et al*., 2020).

- Gathering information on bat species that inhabit the project site, noting higher, medium, or lower risk species groups.
- Recording relative frequency of use by different species throughout the monitoring year.

- Monitoring the spatial and temporal distribution of activity for different species.
- Identifying locations of roosts within and close to the project site.
- Provide details on how the surveys have been designed to determine the presence of rarer species.
- Describing the type of use of the project site by bats; for example, their relative position from the turbine locations in terms of foraging, commuting, migrating, and roosting, as can be observed through the monitoring data and site visits.

## 1.2 Assessment Methodology

Acoustic monitoring of the echolocation calls of bats was used to determine the seasonal and diurnal activity patterns of bats at the proposed Patatskloof WEF site. The *South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – Pre-Construction* (MacEwan *et al.,* 2020), was followed throughout the monitoring process. The following South African Guidelines were used in conjunction with the pre-construction guidelines:

- South African Bat Fatality Threshold Guidelines (MacEwan *et al*., 2018).
- Mitigation Guidance for Bats at Wind Energy facilities in South Africa (Aronson *et al*., 2018).
- Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson *et al*., 2020).

The following approach was followed as per the ToR provided during the proposal phase of the bat monitoring:

- A desktop study was conducted of available literature to establish which species occur in the area. This includes the information about the surrounding area and from other wind developments in the area, where accessible.
- A background was provided regarding ecosystem services provided by bats and the impact of a loss of bats on the broader environment.
- The local and global conservation status of all identified bat species was determined.
- Reconnaissance site visits were conducted as part of the initial project screening phase which included the installation of bat detecting equipment.
- Four site visits were conducted which included seasonal surveys and daytime investigations. These covered all the various biotopes occurring on the project site.

- The monitoring equipment was set up and verified. Data was downloaded throughout the monitoring year and echolocation calls were analysed.
- Interviews were conducted with the landowner(s) regarding possible bat occurrence on the property and the surroundings.
- Inputs were provided to inform the turbine layout.
- Information was gathered from other wind farm developments in the close vicinity of the proposed Patatskloof WEF site to assess the cumulative impact of this proposed WEF together with other developments.
- Potential impacts were identified and the potential significance thereof was predicted.
- Mitigation measures were recommended.

The methods of investigation of bats at the proposed WEF are described below:

### *1.2.1 Desktop investigation of the development area as well as the surrounding environment*

A desktop study was conducted of the project site itself, which was informed by information provided by the applicant and a literature review. Conservation areas in the vicinity of the study area were investigated and other renewable energy developments, particularly wind farms, were noted for the discussion of cumulative effects.

### *1.2.2 Passive Acoustic Monitoring Systems*

Passive acoustic monitoring was conducted between 11 June 2021 and 27 June 2022. Four seasonal site visits were conducted, during which, amongst other tasks, data were downloaded. The results of the data are discussed in Section 5. The monitoring systems consisted of Five Wildlife Acoustics SM4BAT full spectrum bat detectors that are powered by 12V, 7 Amp-h sealed lead acid batteries replenished by photovoltaic (PV) solar panels, see Table 1. Two SD memory cards, class 10 speed, with a capacity of 64 GB or 128 GB each, were utilised within each detector to ensure substantial memory space with high-quality recordings, even under conditions of multiple false environmental triggers.

**Table 1: Summary of Passive Detectors deployed at the proposed Patatskloof WEF site**

| Detector | Situation | Coordinates | Microphone | Division ratio | High pass filter | Gain | Format | Trigger window | Approximate calibration (on chirp) at the microphone |
|---|---|---|---|---|---|---|---|---|---|
| SM4BAT (Met A) | Met mast: mic at 105 m | 33º06'09,36" S, 20º07'57,64" E | SMM-U2 | 8 | 16 kHz | 12 dB | FS, WAV@ 384kHz | 1 sec | -9,53 dB at the microphone |
| SM4BAT (Met B) | Met mast: mic at 55 m | 33º06'09,36" S, 20º07'57,64" E | SMM-U2 | 8 | 16 kHz | 12 dB | FS, WAV@ 384kHz | 1 sec | -7,7 dB at the microphone |
| SM4BAT (Met C) | Met mast: mic at 12 m | 33º06'09,36" S, 20º07'57,64" E | SMM-U2 | 8 | 16 kHz | 12 dB | FS, WAV@ 384kHz | 1 sec | -7,50 dB at the microphone |
| SM4BAT (10 m Mast G) | Temporary 10 m mast: mic at 9 m | 33º08'57,4" S, 20º08'41,8" E | SMM-U2 | 8 | 16 kHz | 12 dB | FS, WAV@ 384kHz | 1 sec | -52 dB at 9 m |
| SM4BAT (10 m Mast H) | Temporary 10 m mast: mic at 9 m | 33º06'28" S, 19º53'10" E | SMM-U2 | 8 | 16 kHz | 12 dB | FS, WAV@ 384kHz | 1 sec | -8,64 dB at the microphone |

Each detector was set to operate in continuous trigger mode from dusk each evening until dawn. Times were correlated with latitude and longitude and set to trigger half an hour before sunset. The trigger mode setting for the bat detectors, which record frequencies exceeding 16 kHz and -18 dB, was set to record for the duration of the sound and 1 000 milliseconds (ms) after the sound ceased; this period is known as the trigger window, see Table 1.

The data from these recorders were downloaded every two to four months and analysed to provide an approximation of the bat frequency and species diversity that visit and inhabit the project site.

The position of the Met mast was decided by the developer. A number of factors influence the planning, positioning and installation of temporary masts for bat monitoring equipment. Different biotopes[1] must be represented and the proximity to possible bat conducive areas must be considered. As prescribed by the pre-Construction Bat Monitoring Guidelines (MacEwan *et al*., 2020), three bat monitoring systems were

[1] The region of a habitat associated with a particular ecological community.

placed on the Met mast, with one sampling point at 105 m, one at 55 m and one at 12 m, see Table 1. The Met mast position was representative of the largest part of the development area and represented the central section of the wind farm. The systems situated within the future sweep[2] of the turbine blades are deemed the most important, as the data are representative of the bats that will be at high risk when the turbines are turning. The positions of the monitoring stations are depicted in Figure 1.

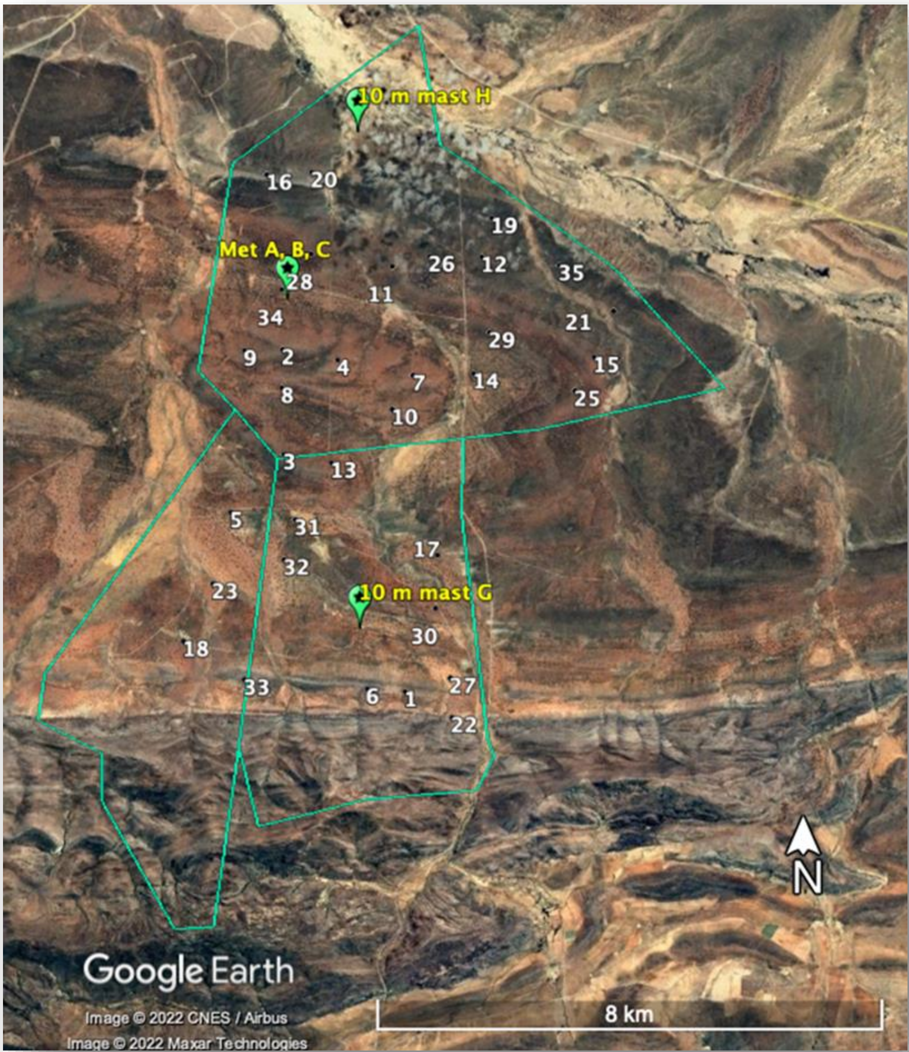



**Figure 1: Positions of monitoring stations at Patatskloof WEF**

[2] Area covered as a wind turbine rotates around in a circle.

The positions of the 10 m masts on the project site are motivated below:

- **10 m Mast G**: This monitoring system (Figure 2) represented the biotope towards the south of the proposed WEF and was situated close to the southern mountain range. An open farm dam was situated north of the system, with the Bonteberg towards the south. System G had recorded bats roosting in the mountainous areas, with ample roosting opportunities, who might have traversed the development terrain to come and drink water at the open water source.

- **10 m Mast H:** This monitoring system represented the biotope towards the north of the proposed wind farm, in the proximity of the Grootrivier. This area with typical Karoo riverine vegetation is different in terms of vegetation and geography compared to the southern part of the project site. Ample roosting opportunities are present in the valley areas and the relatively dense bush along the river.

**Figure 2: Monitoring System G on a 10 m temporary mast in the north-western portion of the proposed wind farm**

### *1.2.1 Roost Surveys*

During site visits, roost searches were conducted. Areas, where roosts could be situated, were investigated, but it is not always possible to access all roosts as they could be in rock crevices or roofs with limited ceiling space. If day roosts were identified, bat counts were done during sunset and if deemed necessary detectors were installed for short periods at point sources to monitor roosts. It should be noted that the project site is large, and it was not possible to search the whole project site for roosts within the timeframe and limitations of the bat monitoring study. Therefore, roost searches were concentrated in areas such as rocky outcrops or features that are favourable for bat roosts.

### *1.2.1 Driven transects*

Transects provide a snapshot in time and could confirm bat species or activity for that night. A SM4BAT full spectrum recorder with the microphone mounted on a pole was used for transect surveys, see Figure 3. Starting at sunset up to approximately two hours after sunset, the vehicle was driven at a speed of between 10 to 20 km/h along a set route. All transect routes were the same so that seasonal data can be compared. See Section 6 for the transect route and discussion of transects at Patatskloof WEF.

**Figure 3: Microphone mounted on a vehicle for transects**

### *1.2.1 Data Analysis*

Data were downloaded manually approximately once every two to four months. Acoustic files downloaded from the detectors were analysed for bat activity such as the number of bat passes and the bat species composition, where possible. The latest version of Wildlife Acoustics Kaleidoscope Pro was used for analysing large quantities of data. Data analysed electronically were regularly tested by hand to establish the accuracy of electronic data analysis. In cases where there was uncertainty about a bat call, the call was classified as “unclear”.

### *1.2.1 Sources of Information*

#### *1.2.1.1 Information used in the Bat Impact Assessment*

**Bats and environmental information:**

- South African Bat guidelines as prescribed by the South African Bat Assessment Association, particularly South African Good Practice Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-construction Monitoring of Bats at Wind Energy Facilities. MacEwan *et al.* 2020.
- Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. University of the Witwatersrand, Johannesburg. Monadjem *et al*. 2010, as well as the 2020 editions.
- Academic references and papers, as per the reference list.
- **Climate and precipitation data sourced from various websites:** AccuWeather; Meteoblue; Climate.org, MSN.com, World Weather Online, Yr.no.

## Environmental and other related Legislation:

- Department of Forestry, Fisheries and the Environment: https://egis.environment.gov.za/data_egis/data_download/current.
- South African Energy Integrated Resource Plan 2010-2030 promulgated 3/2011 www.Energy.gov.za.

## Personal conversation:

Personal conversations during fieldwork sessions were conducted with the farm manager of Ibhadi guest house, who stays permanently on the farm, to establish if he was aware of any bat roosts on the properties and whether there are certain times of the year when there is higher bat activity on the proposed site. He indicated that during warmer nights in summer, there are numerous bats foraging at the lights of the guest house buildings.

## Process information sourced from the client:

- Satellite images.
- Google Earth: https://www.google.com/earth/download/html.

## Vegetation:

- Red List of South African Plants SANBI.
- South African National Biodiversity Institute, 2012: Vegetation Map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012. Available from the Biodiversity GIS website, http://bgis.sanbi.org/SpatialDataset/Detail/18.
- The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19, South African National Biodiversity Institute, Pretoria. Mucina, L., and Rutherford, M.C., 2006.

### *1.2.2 Importance of Bats*

Bats are the second largest group of mammals after rodents (Pennisi, 2020). More or less 62 bat species occur in South Africa (De Villiers, 2022). Bats play important functional roles as insect predators, pollinators, and seed dispersers. For numerous cacti species in the world, fruit bats serve as the main pollinators because these plants open their flowers during the night (National Science Foundation, 2012).

Bats can be classified into three broad functional groups based on their wing morphology and echolocation call structure, namely: clutter, clutter-edge, and open-air foragers. Of these three groups, open-air foragers (i.e., bats that have a wing design and echolocation calls adapted to flying fast and high above the vegetation) are mostly at risk from wind turbine developments. However, all species that migrate over the proposed development will be further at risk regardless of their foraging behaviour.

Mortality and disturbance resulting from wind turbine developments present a primary threat to bats. In addition, the major threats faced by bats include habitat destruction and change, cave (i.e., roosting) disturbance, and natural disasters (Geda and Balakrishnan, 2013). Bat populations are sensitive to changes in mortality rates and tend to recover slowly from declines. In general, human-caused environment-related concerns include the reduction in the number of food resources, overhunting of bats for bush meat, the maltreatment of bats due to misguided fears, such as those related to Covid-19 and a rise in the usage of pesticides (MacFarland and Rocha, 2020; Geda and Balakrishnan, 2013). According to scientists, bats are one of the most endangered groups of animals on our planet (Bottollier-Depois, *et al*., 2021).

The economic consequences of a widespread loss of bat populations could be substantial, even more so for sensitive semi-desert environments. Although the loss of bats in Southern Africa has not been quantified in economic terms, literature indicates that insectivorous bats play a crucial role in the disruption of population cycles of agricultural pests (Boyles, *et al*., 2011; National Park Service, 2020), resulting in a reduced cost of pesticides. Quantifying the cost of pesticides by bats controlling pests in the USA, it is believed that more than an estimated $3,7 billion are saved (National Park Service, 2020).

The consumption of insects by insectivorous bats also plays a role in the control of diseases that afflict humans, such as malaria and dengue. Insectivorous bat species consume large numbers of mosquitoes (typically equivalent to their own body weight per night) and flies, the most important vectors in the transmission of these diseases (Monadjem, *et al*., 2010; National Science Foundation, 2012). Malaria afflicts millions of people in Africa and the contribution bats make to reduce the number of insects that transmit diseases should not be underestimated (Monadjem, *et al*., 2010).

Several distinctive attributes of bats, including the membranes of bat wings and their echolocation, were the inspiration behind some technology-related breakthroughs within the field of engineering, such as drones' navigating sonar systems (National Park Service, 2020; National Science Foundation, 2012). Further examples are base jumper wingsuits, sonar navigation for ships and ultrasound.

Studies have revealed that blind people, as well as those that are visually impaired, have the capability of using echolocation to establish the position where an object is located (Science Daily, 2013). Also, scientific researchers have exploited the saliva of vampire bats to see if it could be used as a practicable medication to treat strokes in human beings (ESA, 2011). The same enzyme capable of preventing blood to coagulate when vampire bats feed, has the likelihood to support stroke patients in preventing or breaking down blood clots. The drug derived is known as "Draculin".

#### *1.2.2.1 Dominant bat species at Patatskloof WEF*

a) *Tadarida aegyptiaca* (Egyptian free-tailed bat)

In the Karoo environment, and at the Patatskloof WEF, *Tadarida aegyptiaca* (Egyptian free-tailed bat), has proven to be the most vulnerable to date. This bat is known to forage over a wide variety of habitats (an approximate range of occurrence of 1,340,000 km$^2$) (Eiting, 2020; Monadjem *et al*., 2020). Generally, *T. aegyptiaca* flies effortlessly above the vegetation's canopy, which includes agriculture-related fields, grassland, savanna, semi-desert scrub, as well as desert habitats (Monadjem *et al*., 2020). *T. aegyptiaca* consumes insects included in the orders Lepidoptera (butterflies and moths) and Hymenoptera (sawflies, wasps, bees, and ants), which are considered pest insects in agricultural systems (Eiting, 2020). This bat tends to move away from clutter and is a true open-air forager. Within arid environments, the presence of these bats is associated with water bodies that do not dry up and or standing water that attracts concentrated densities of insects. *T. aegyptiaca* females only gives birth to a single pup annually.

In previous years, before the increase in wind energy facilities, *T. aegyptiaca* was not perceived to be under threat, (MacEwan *et al*., 2016), as their distribution is widely spread over Southern Africa. However, currently there is a serious cumulative threat from WEFs. Furthermore, the possibility that *T. aegyptiaca* could be subdivided into more than one species or sub-species is at present being debated amongst zoologists and genetics specialists. If this is the case, wind farms concentrated in certain biomes in South Africa could threaten a species or sub-species that has not been described yet. Of all the South African bat species, preliminary data indicates that *T. aegyptiaca* presents the highest fatality and with a sharp increase in wind energy facilities, one could expect that this trend will continue.

# 2. ASSUMPTIONS AND LIMITATIONS

The following limitations apply to this study:

- Knowledge of several ecological aspects and behaviours, such as migration distances, flying height, population sizes, temporal movement patterns, etc., of several South African species is limited. Consequently, the impact of WEFs on several bat species is also unknown.
- Monitoring of bats with acoustic detectors is an internationally accepted method to assess bat activity levels and species richness; however, the use of bat detectors has limitations. Acoustic monitoring can only provide an estimate of relative bat activity levels and does not provide estimates of total population or how many individuals are present on the project site, as the same individual could pass the detector more than once.
- Due to an overlap of calls, it is not possible to provide an exact number of bats passing the recorder. Therefore, the number of bats passing is not an exact count but is as close as possible under the given circumstances and within the limitations of the survey technique applied.
- The recording of echolocation calls is dependent on the species being recorded (some species emit 'softer' calls than others do) and weather conditions (high humidity and high wind speeds will reduce recording distance as it attenuates call intensity). Therefore, any monitoring based on echolocation calls covers only a limited area, depending on the type and intensity of the call.
- The accuracy of the species identification is also dependent on the quality of the calls. Species identification by echolocation calls is complex. Bats alter the frequencies and durations of their calls based on whether they are feeding, commuting, or migrating. They may also alter call characteristics based on the habitat and surrounding vegetation. There are several species with overlapping frequencies that makes identification challenging. For this study, if the species of a recording is unidentifiable, the species identification of the recording was marked as 'unsure'. Recordings for which the species identification is 'unsure' were still included in the analysis.
- Transects only provide a snapshot in time and do not convey spatial distribution of bat activity across the project site. However, transects are useful in eliciting areas or time periods of high activity for the duration of the site visit.
- It is not possible to find all the bat roosts; especially beyond the proposed wind farm. However, the project site was driven and walked through as thoroughly as possible, within the time constraints of a bat impact assessment.
- The data collected during this study provided a baseline of bat activity across the project site for the relevant monitoring period. Future bat activity patterns and inter-annual variation cannot be accurately

inferred from this data, and as such, future bat activity could vary substantially from the results presented here.

# 3. TECHNICAL DESCRIPTION

## 3.1 Project Location

The proposed WEF and associated grid infrastructure are located approximately 25 km northeast respectively of Touws River within the Witzenberg Local Municipality and the Cape Winelands District Municipality in the Western Cape Province, see Figure 4.

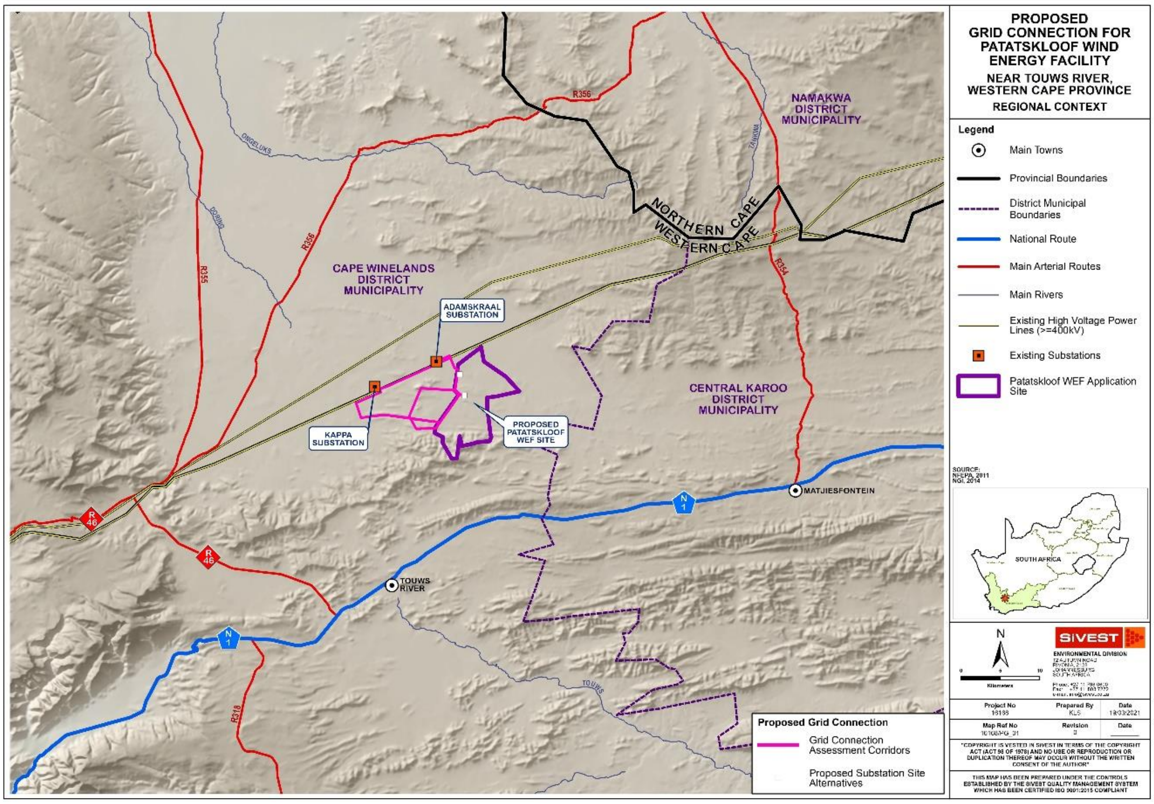



**Figure 4: Regional Context Map**

### *3.1.1 WEF*

The WEF site, as shown in Figure 5 below is approximately 6 612 ha in extent and incorporates the following farm portions:

- Remainder of the Farm Upper Stinkfontein No 246.
- Remainder of the Farm Upper Melkbosch Kraal No 250.
- Portion 1 of the Farm Drinkwaters Kloof No 251.

A smaller area (2 905.4 ha) on which the WEF will be built has been identified through a preliminary suitability assessment undertaken by Mainstream. This area is likely to be further refined with the exclusion of sensitive areas identified through the various specialist studies being conducted as part of the EIA

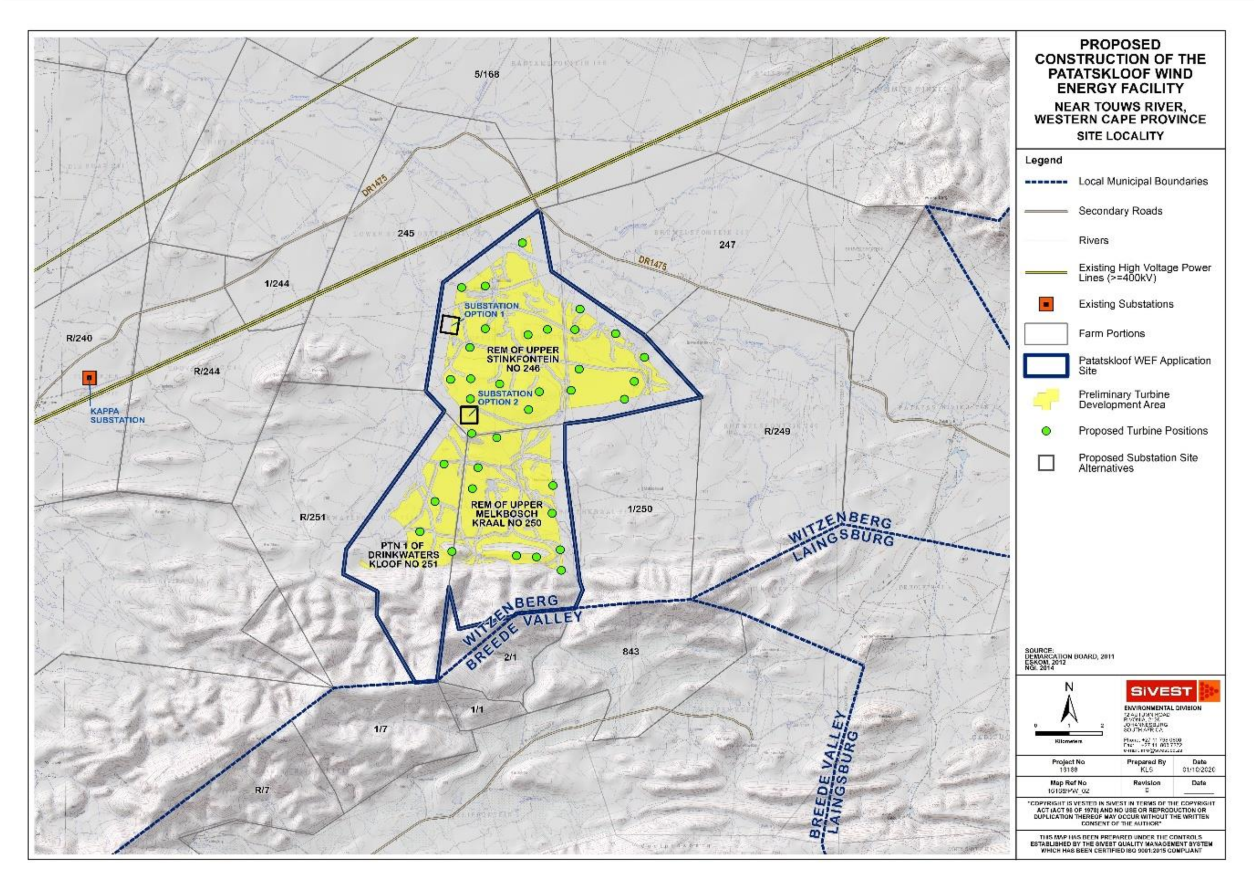



**Figure 5: Patatskloof WEF Site Locality**

process.

### *3.1.2 Grid Connection*

It is currently proposed that the 132 kV power lines will connect the Patatskloof WEF on-site substation to the national grid, either via the existing Kappa Substation or via the Adamskraal substation (Figure 6).

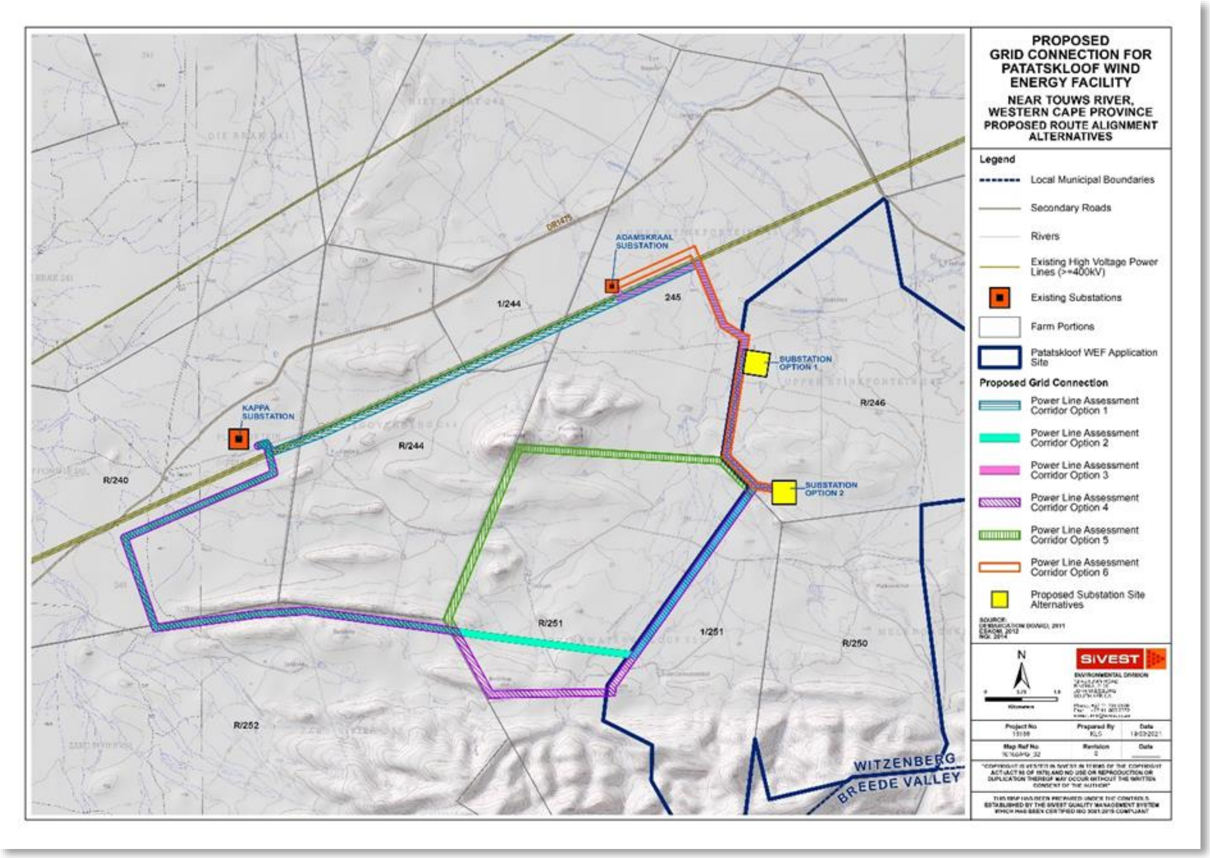



**Figure 6: Proposed 132 kV Power Line Route Alignment**

## 3.2 Project Description

It is anticipated that the proposed Patatskloof WEF will comprise up to 35 wind turbines with a maximum total energy generation capacity of up to 250 MW. The electricity generated by the proposed WEF development will feed into the national grid via a 132 kV overhead power line. The 132 kV overhead power line will however require a separate Environmental Authorisation (EA) and is subject to a separate BA process, which is currently being undertaken in parallel to the WEF BA process. This assessment does not consider the impact of the line on bats.

### *3.2.1 Wind Farm Components*

- Up to 35 wind turbines, each between 4 MW and 6.6 MW, with a maximum export capacity of approximately 250 MW are proposed. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The final number of turbines and the layout of the WEF will, however, be informed by the outcome of the numerous Specialist Studies conducted during the BA process.

- Each wind turbine will have a hub height of between 120 m and 200 m and rotor diameter of up to approximately 200 m.
- Permanent compacted hard standing areas /platforms (also known as crane pads) of approximately 100 m x 100 m (total footprint of approximately 100 00 $m^2$) per turbine will be constructed, allowing for construction and on-going maintenance purposes for the lifetime of the proposed development.
- Each wind turbine will consist of a foundation of up to approximately 30 m in diameter. In addition, the foundations will be up to approximately 4 m in depth.
- Electrical transformers (690 V/11 to 33 kV) adjacent to each wind turbine (typical footprint of up to approximately 3 m x 2.5 m) will be installed to step up the voltage to between 11 kV and 33 kV.
- One new 11 kV - 33/132 kV on-site substation, including associated equipment and infrastructure, occupying an area of approximately 2 ha (i.e., 20 000 $m^2$) is proposed. The proposed substation will be a step-up substation and will include an Eskom portion and an IPP portion. The substation has thus been included in the WEF BA and in the grid infrastructure (substation and 132 kV overhead power line) BA, to allow for handover to Eskom. Following construction, the substation will be owned and managed by Eskom. The current applicant will retain control of the low voltage components (i.e., 33 kV components) of the substation, while the high voltage components (i.e., 132 kV components) of this substation will be ceded to Eskom shortly after the completion of construction.
- A Battery Energy Storage System (BESS) will be located next to the on-site 33/132 kV substation to be included in the 2 ha substation area. The storage capacity and type of technology would be determined at a later stage during the development phase, but will most likely comprise an array of containers, outdoor cabinets and/or storage tanks.
- The wind turbines will be connected to the proposed substation via 11 to 33 kV underground cabling and overhead power lines.
- A road servitude of 8 m and a 20 m is allowed for underground cables or overhead lines, respectively.
- Internal roads with a width of up to approximately 5 m wide will provide access to each wind turbine. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary. Turns will have a radius of up to 50 m for abnormal loads (especially turbine blades) to access the various wind turbine positions. It should be noted that the proposed application site will be accessed via the N1 National Route and DR1475, MR316 and MR319 WCG provincial Roads. One construction laydown / staging area of up to approximately 3 ha will be located on the project site identified for the substation. It should be noted that no construction camps will be required in order to house workers overnight as all workers will be accommodated in the nearby town.
- Operation and Maintenance (O&M) buildings, including offices, a guardhouse, an operational Control Centre, an O&M area / warehouse / workshop, and ablution facilities will be located on the project site identified for the substation. This will be included in the 2 ha substation area.
- A wind measuring lattice (approximately 120 m in height) mast has already been strategically placed within the wind farm application site in order to collect data on wind condition.
- No new fencing is envisaged at this stage. Current fencing is a standard farm fence approximately 1 to 1.5 m in height. Fencing might be upgraded to up to approximately 2 m in height, if required.
- Water will either be sourced from existing boreholes located within the application site or will be trucked in, should the boreholes located within the application site be limited.
- An optic fibre overhead or underground line from the Adamskraal Substation to the proposed on-site substation will be installed.

### *3.2.2 Grid Components*

The proposed grid connection infrastructure to serve the Patatskloof WEF, which has not been assessed as part of this study, will include the following components:

- One new 11-33/132 kV on-site substation, occupying an area of up to approximately 2 ha. The proposed substation will be a step-up substation and will include an Eskom portion and an IPP portion, as stated above, to allow for handover to Eskom. The applicant will remain in control of the low voltage components (i.e., 33 kV components) of the substation, while the high voltage components (i.e., 132 kV components) of this substation will likely be ceded to Eskom shortly after the completion of construction.
- One new 132 kV overhead power line connecting the on-site substation to either Kappa Substation or Adamskraal Substation and thereby feeding electricity into the national grid. Power line towers being considered for this development include self-supporting suspension monopole structures for relatively straight sections of the line and angle strain towers where the route alignment bends to a significant degree. Maximum tower height is expected to be approximately 25 m.

## 3.3 Alternatives

### *3.3.1 Wind Energy Facility*

No other activity or site alternatives are being considered. Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view and a WEF is considered suitable for this site due to the high wind resource in this area.

The choice of technology selected for the Patatskloof WEF is based on environmental constraints and technical and economic considerations. No other technology alternatives are being considered as wind energy facilities are more suitable for the project site than other forms of renewable energy, such as solar, due to the high wind resource.

The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. The choice of the turbine to be used will ultimately be determined by technological and economic factors at a later stage.

Design and layout alternatives will be considered and assessed as part of the environmental assessment. These include alternatives for the Substation locations and also for the construction/laydown area. The proposed preliminary layout is shown in Figure 7 below.

### 3.3.2 Grid Components

The grid connection infrastructure proposals include two substation site alternatives, each of which are 25 ha in extent, and six power line route alignment alternatives (Figure 8). These alternatives will be considered and assessed as part of the BA process and will be amended or refined to avoid identified environmental

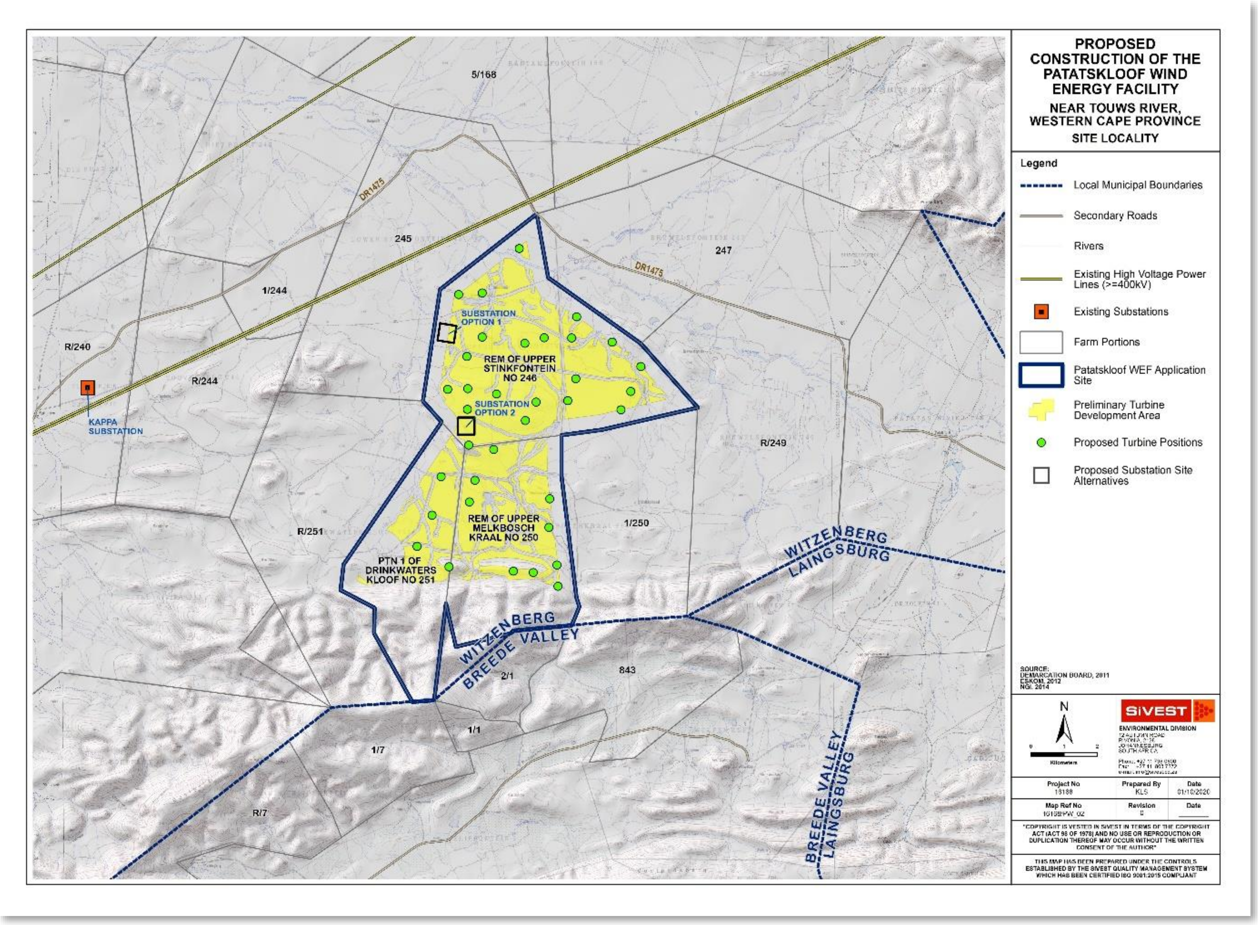



**Figure 7: Preliminary Turbine layout and development area**

sensitivities. All power line route alignments will be assessed within a 150 m wide assessment corridor (75 m on either side of power line). These alternatives are described below:

- Power Line Corridor Option 1 is approximately 16 km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation.
- Power Line Corridor Option 2 is approximately 24 km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation.
- Power Line Corridor Option 3 is approximately 8 km in length, linking either Substation Option 1 or Substation Option 2 to Adamskraal Substation.
- Power Line Corridor Option 4 is approximately 25 km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation.

- Power Line Corridor Option 5 is approximately 24 km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation. It should be noted that the assessment corridor applied to a short section of this route alignment serving Substation Option 2 has been widened to 300 m.
- Power Line Corridor Option 6 is approximately 8 km in length, linking either Substation Option 1 or Substation Option 2 to Adamskraal Substation.

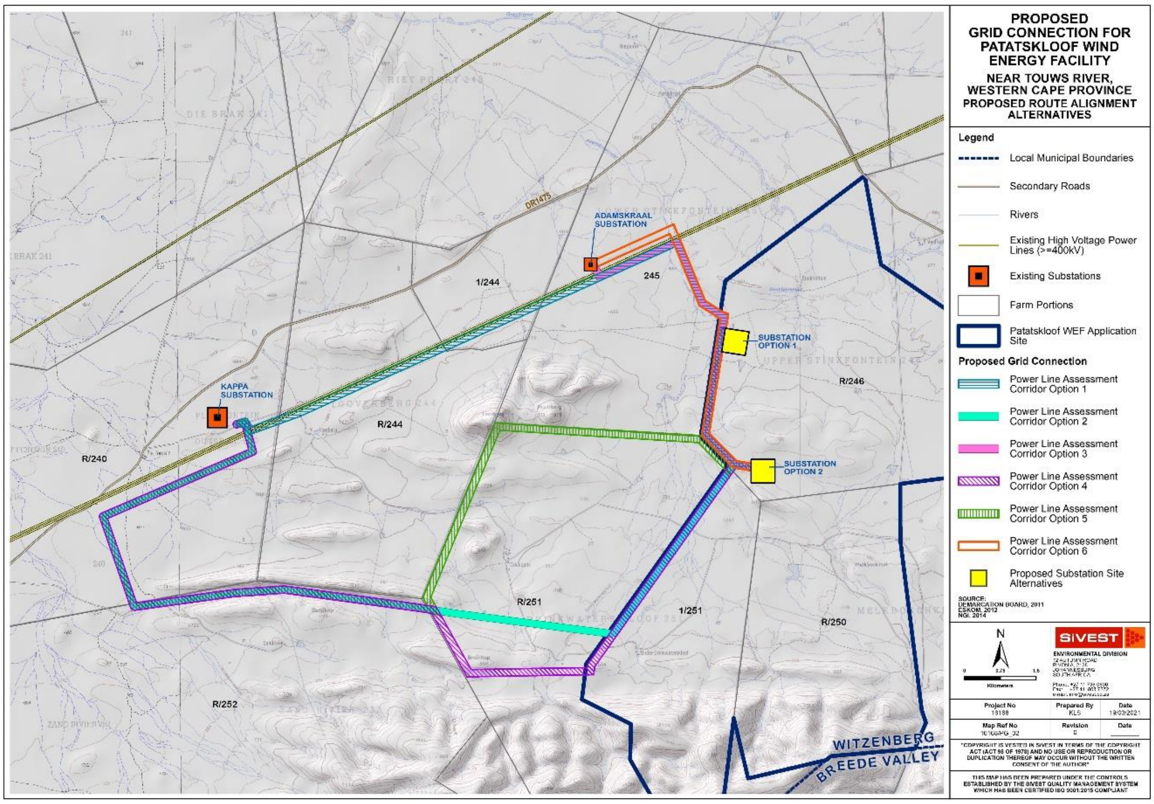



**Figure 8: Proposed Substation and Power line options**

### *3.3.3 No-go Alternative*

The 'no-go' alternative is the option of not undertaking the proposed grid connection infrastructure projects. Hence, if the 'no-go' option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

The 'no-go' option is a feasible option; however, this would prevent the proposed development from contributing to the environmental, social, and economic benefits associated with the development of the renewable energy sector.

# 4. LEGAL REQUIREMENT AND GUIDELINES

Environmental law in the form of legislation, policies, regulations, and guidelines guide and manage development practice to ensure informed decision-making and sound risk management of current and future projects, i.e., the impact of the proposed development on the ambient bat environment on the ambient bat environment. The applicable legislation is listed below:

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996).
- National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA).
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009).
- Convention on the Conservation of Migratory Species of Wild Animals (1979).
- Convention on Biological Diversity (1993).
- The Equator Principles (2013).
- The Red List of Mammals of South Africa, Swaziland, and Lesotho (2016).
- National Biodiversity Strategy and Action Plan (2005).
- Aviation Act (Act no 74 of 1962).

In addition to the laws indicated above, guidelines have also been developed by the South African Bat Assessment Association (SABAA) to inform wind energy development:

- The South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – Pre-Construction (MacEwan *et al.*, 2020).
- Mitigation Guidance for Bats at Wind Energy Facilities in South Africa (Aronson *et al*., 2018).
- South African Bat Fatality Threshold Guidelines (MacEwan *et al*., 2018).
- Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson *et al*., 2020).

# 5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

## 5.1 Background information

A literature review of existing reports, studies and guidelines, legislation and SANBI GIS database, as well as site visits relevant to the study area, were used to inform a background study of the project site and associated environment. The proposed development follows the South African national, regional, and municipal proposition in the Integrated Resource Plan (IRP) 2010-2030 that 17 800 MW of renewable energy capacity should be secured by 2030 (energy.gov.za). Furthermore, wind energy development is an opportunity for the key priority of job creation for the community of Touws River (Laurie, 2018).

## 5.2 Regional Vegetation and climate

### *5.2.1 Climate*

The town of Touws River in the Western Cape has a local steppe climate with a rainfall of approximately 206 mm per annum (Meteoblue, 2021). Touws River is situated 185 km east of Cape Town and is often perceived as the doorway to the Karoo (Karoo Information Travel Directory, 2021). The region around Touws River has a semi-arid climate, see Figure 9. It receives its maximum rainfall during April, with an average of 28 mm falling in this period (Meteoblue, 2021). Typical of a semi-arid climate, this area is dry for 259 days a year (Besttimetovisit.co.za, 2021), while the average humidity in Touws River area is around 57%.

Climatic conditions are extreme and vary from cold winters to hot summers. Extreme summer temperatures of 38 $^{0}$C and winter temperatures of 0 $^{0}$C have been recorded at Touws River. Mean daily maximum summer temperatures from December to March average 29 to 30 $^{0}$C, autumn temperatures from March to May average 21 to 28 $^{0}$C, winter temperatures from June to August range from 16 to 18 $^{0}$C and spring temperatures between September and November average 21 to 26 $^{0}$C (Meteoblue, 2021).

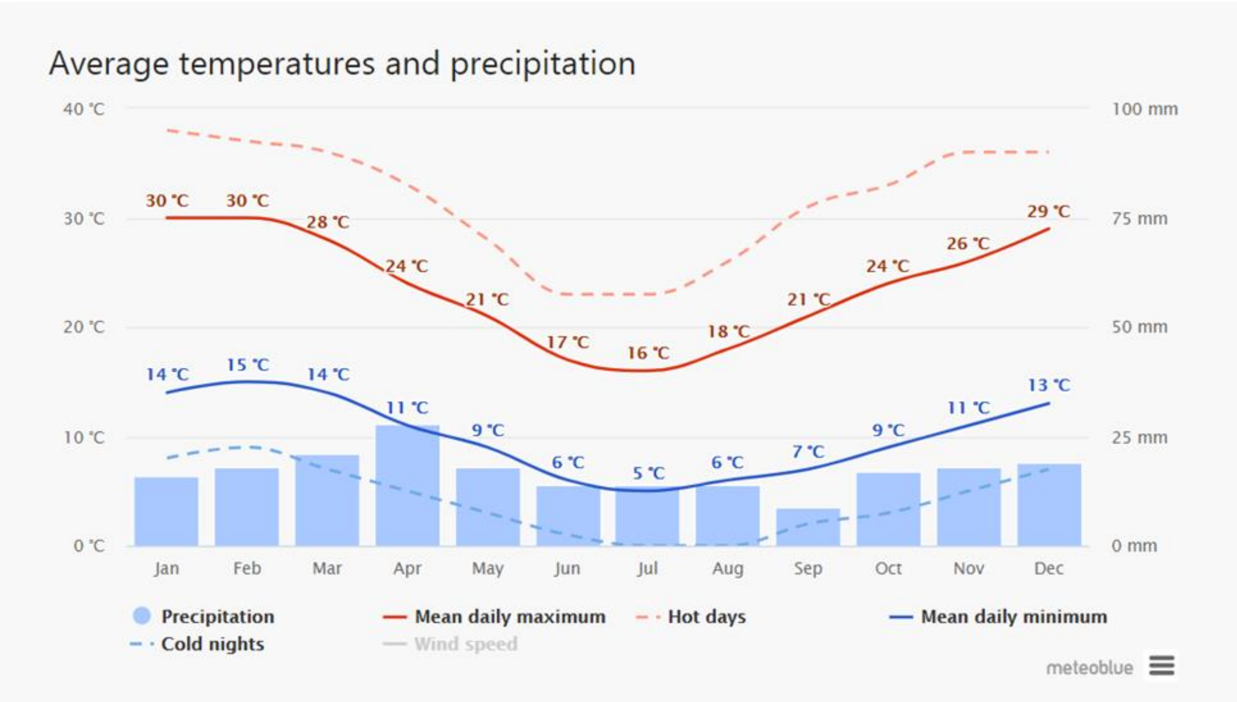



**Figure 9: Climate of Touws River (Meteoblue, 2021)**

### *5.2.2 Vegetation*

The proposed study area falls within the Little Karoo. It comprises Azonal Vegetation, as well as vegetation from two different biodiversity hotspots, namely the Fynbos and Succulent Karoo Biome, see Figure 10. The Fynbos Biome vegetation types include Matjiesfontein Shale Renosterveld and Matjiesfontein Quartzite Fynbos. The Fynbos Biome is possibly the most well-known biodiversity hotspot in South Africa and is furthermore identified as a UNESCO World Heritage Site (Poulson ZC, 2020). The Succulent Karoo Biome has high levels of plant endemism as earth's only entirely arid hot spot of plant diversity (Van Wyk and Smith, 2001). All of the above-mentioned vegetation types have a threat status of Least Concern. Figure 11 illustrates areas of the vegetation zones described above.

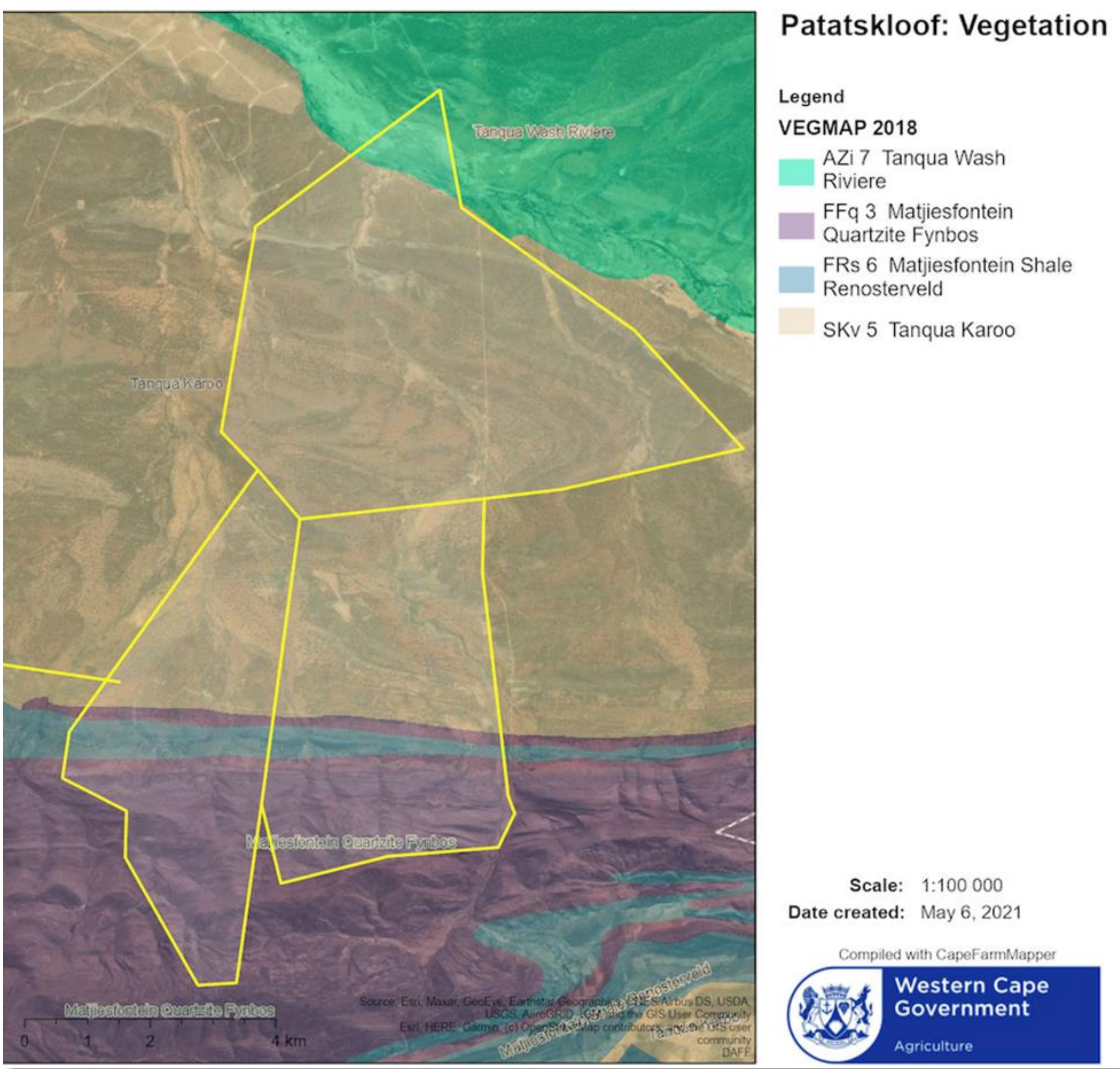



**Figure 10: Patatskloof WEF Vegetation Zones (SANBI, 2012).**

Regionally the project site falls within three bioregions, namely Inland Saline Vegetation, Rainshadow Valley Karoo Bioregion and Western Fynbos-Renosterveld Bioregion. Nature reserves situated in the vicinity of the Patatskloof WEF include Kapklip Private Nature Reserve and its neighbouring Touw Local Nature Reserve, Inverdoorn Private Nature Reserve, as well as Witteberg Nature Reserve and Anysberg Provincial Nature Reserve, see Figure 11. The latter is approximately 25 km from Patatskloof WEF, as the crow flies.

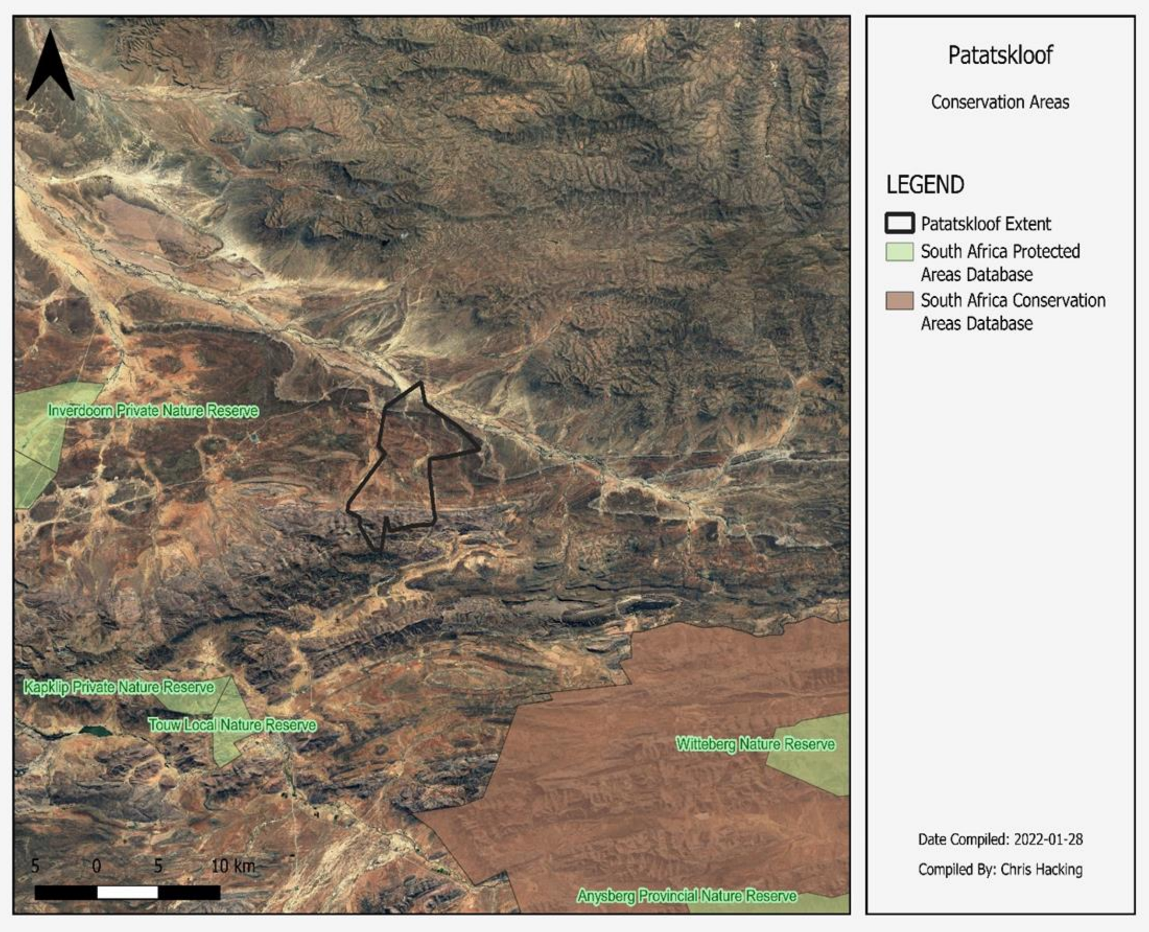



**Figure 11: Protected areas and private nature reserves in the vicinity of Patatskloof WEF**

### *5.2.3 Land use*

As indicated in Figure 12, land use in the development area is dominated by low shrubland, which is utilised for game farming and limited cattle grazing at Patatskloof. Some neighbouring farms in the surrounding area are used for grazing small stock farming. It is not foreseen that the land use will change within the lifespan of the wind farm.

The grazing capacity of the area, mostly known as "suurveld", is low. Land in the wider area which is situated in the REDz is currently regularly leased to developers for solar and wind energy production. The current infrastructure at Patatskloof consists of the Ibhadi guest farm buildings as well as one small cottage at the ravine, farm roads and water points for animals. The buildings, rocky outcrops, trees and natural shrubland, as well as the Fynbos vegetation closer to the mountains and the livestock water points, could be potential sources for bat roosting and foraging areas within the study area.

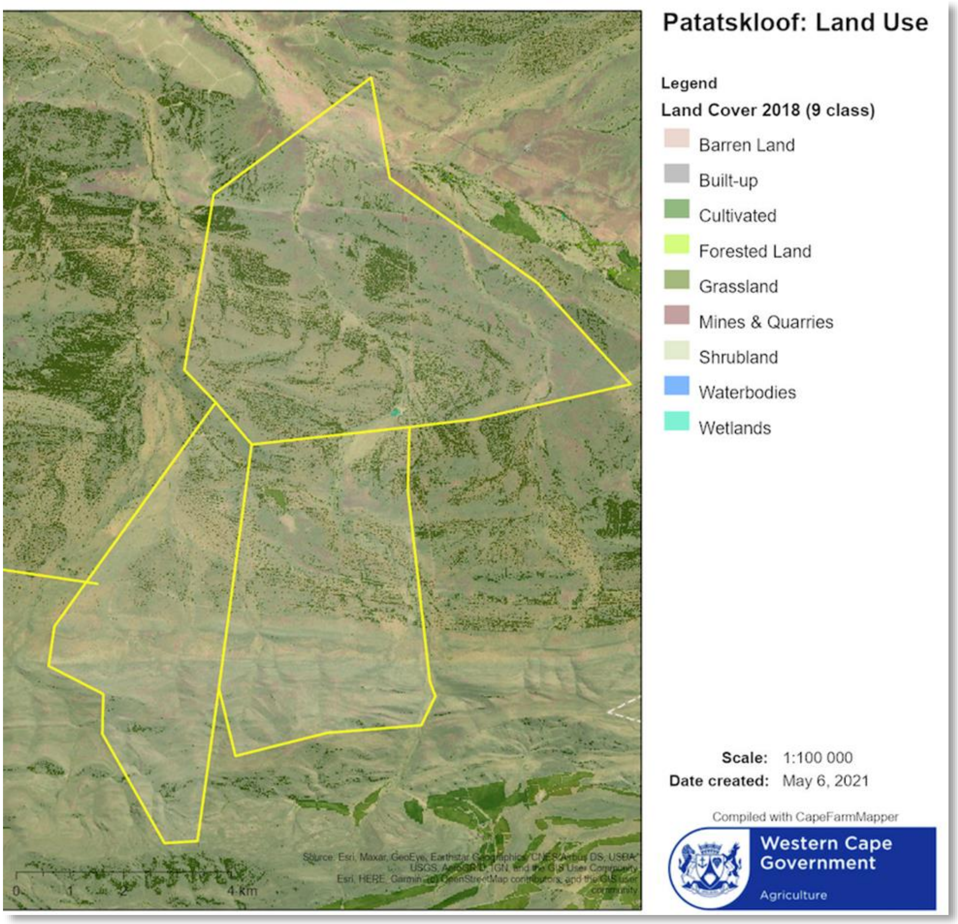



**Figure 12: Land use in the Patatskloof WEF area**

### *5.2.4 Geography*

The elevation of the proposed Patatskloof WEF site varies slightly but remains average in terms of mean height above land. The topographical land elevation ranges from the lower areas around the Grootrivier in the north, gradually increasing in altitude towards the mountainous areas in the south. The Met mast, which is situated on the central to north-western section of the wind farm, is at an elevation of 666 m above sea level, and subsequently, is also the lowest point of elevation on the wind farm. There is a gradual rise in elevation towards the south of the Patatskloof WEF site, with the middle section between 736 m and 754 m, while the southern section is between 798 m and 813 m.

A prominent ravine is situated in the central to the southern section of the project site, while the non-perennial Grootrivier runs along the northern area. There are also various dry gullies on the project site which collect water during rainy spells. This is significant for bat populations, as bats might be drawn to the open water for drinking. Furthermore, the standing water could be a potential breeding ground for mosquitoes and other insects, which in its turn attract bats.

The Succulent Karoo Biome generally occurs on flat areas or gentle hills at an altitude below 800 m (but occasionally up to 1500 m) and this is the case for most of the Patatskloof WEF development area. The soil type for this region is generally lime-rich, with weakly developed soil on rock (South African National Biodiversity Institute, n.d.).

## 5.3 Features conducive to bats at the WEF

Bats are dependent on suitable roosting sites provided mainly by human structures, vegetation, exfoliating rock, rocky outcrops, derelict mine and aardvark holes and caves (Monadjem *et al*., 2020). The foraging utility of a site is further determined by water availability and availability of food. Thus, the vegetation, geomorphology and geology of an area are important predictors of bat species diversity and activity levels.

### *5.3.1 Vegetation*

Although some bush cover occurs within the proposed WEF site, most of the project site comprises typical low Karoo bush. Reletively dense bushes in the valleys could provide roosting opportunities for those bats that may prefer roosting in vegetation or under the bark of trees, see Figure 13.

**Figure 13: Relative dense vegetation in the valley areas at the proposed Patatskloof WEF**

### 5.3.2 *Rock formations and rock faces*

Large boulders and rock formations are found in the ravine in the central to southern section of the project site and along the in the mountainous area towards the southern border of the development area, see Figure 14.

**Figure 14: Rock formations along the ravine valley sides in the central to southern section of the farm**

### 5.3.3 *Human dwellings*

Where roofs are not sealed off, human dwellings could provide roosting space for some bat species. Although no day roost was found at the Ibhadi Guest House, bats were observed in the evenings during fieldwork sessions. The permanent resident at the house also indicated that, especially during warmer nights, many bats are attracted to the area. The swimming pool and lights, together with the relative higher insect presence, are contributing to the attraction of bats to the area.

*5.3.4 Open water sources*

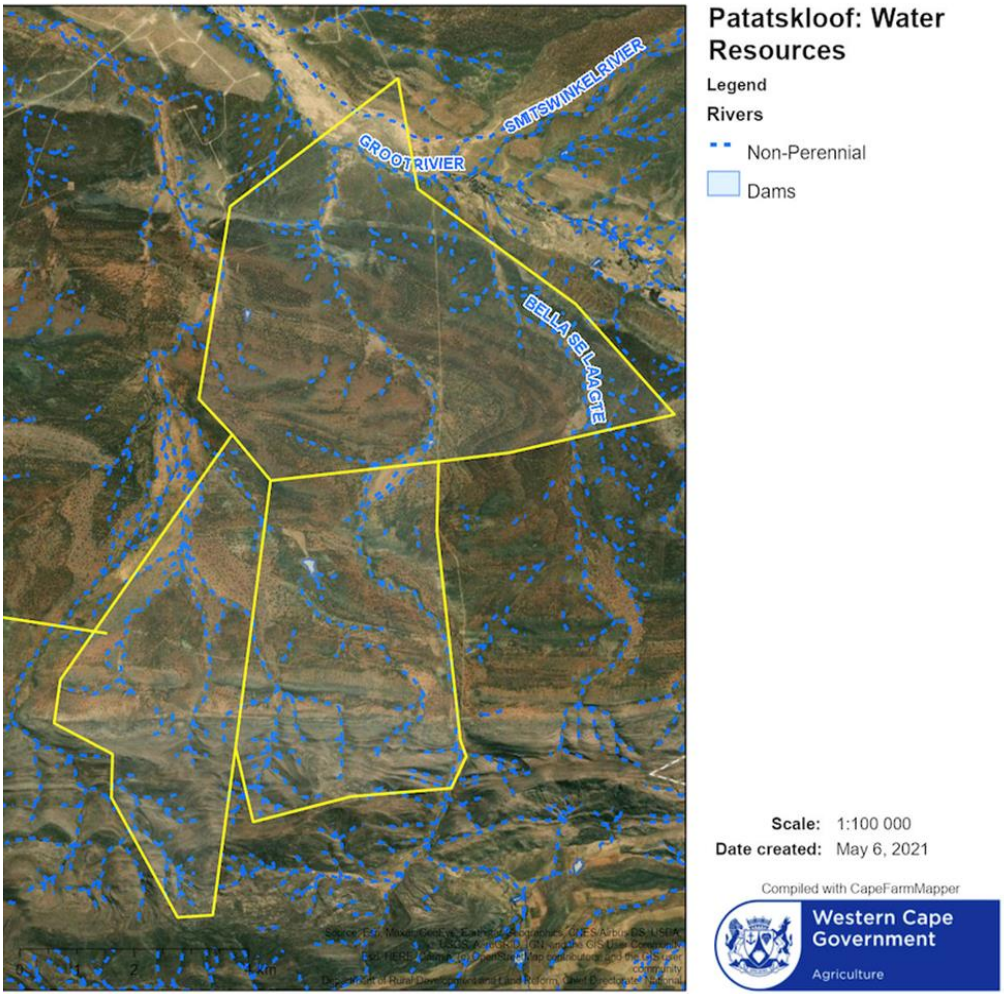



**Figure 15: Water Resources in the Patatskloof WEF area**

Dams and non-perennial rivers provide open water sources for bats after periods of rain. Figure 15 depicts non-perennial watercourses at the proposed Patatskloof WEF. According to the Bat Monitoring Guidelines (MacEwan, *et al*., 2020), buffers must be placed around water sources, but as some of the lower order streams are typical dry gullies found in the Karoo, which do not maintain Karoo riverine vegetation and very little water retention. Care will be taken when compiling the sensitivity map to incorporate such areas. It is important to exclude the ravine in the central areas of the project site from development. Not only is this ravine an important water course, but the steep valleys and rock faces render it an important bat corridor with ample roosting opportunities.

### *5.3.5 Food sources*

Stagnant water that usually collects in small pans and dry ditches during the few spells of rain could serve as a breeding ground for insects, which could provide a source of food for bats. High insect activity could result in higher bat presence after sporadic rainy periods. Livestock is also an attraction to flies, which in turn could serve as a food source for bats.

## 5.4 Background to bats in the area

The extent to which bats may be affected by the proposed WEF will depend on the extent to which the proposed development area is actively used as a foraging site or as a flight path by local bats.

A summary of bat species distribution, their feeding behaviour, preferred roosting habitat, and conservation status is presented in Table 2.The bats mentioned in the table below have distribution ranges that cover the proposed Patatskloof WEF development and bats that had been confirmed on the project site itself or on other wind farms in the area, are marked as such. The proposed wind farm falls within the distributional ranges of five families and approximately 10 species. Table 2 follows the most recent distribution maps of Monadjem *et al.* (2010 and 2020). It should be noted that this table will be adapted as the monitoring progresses to the operational phase.

Of the 12 species which have distribution ranges overlaying the proposed development area, four have a conservation status of Near Threatened in South Africa and one vulnerable, while three have a global conservation status of Near Threatened. *Rhinolophus capensis* (Cape horseshoe bat), *Eptesicus hottentotus* (Long-tailed serotine) and *Cistugo seabrae* (Angolan wing-gland bat) are endemic to Southern Africa, and mainly due to agricultural activities have limited suitable habitat left (Monadjem, 2010).

According to the likelihood of fatality risk, as indicated in the latest Pre-Construction Guidelines (Sowler *et al*., 2017), four species, namely *Miniopterus natalensis* (Natal long-fingered bat), *Tadarida aegyptiaca* (Egyptian free-tailed), *Sauromys petrophilus* (Roberts's flat-headed bat) and *Neoromicia capensis* (Cape serotine), have a high risk of fatality. The high risk of fatality for *T. aegyptiaca* and *S. petrophilus* are due to their foraging habitat at high altitudes. *Myotis tricolor* (Temminck's myotis bat) has a medium to high risk of fatality while *E. hottentotus* has a medium risk of fatality.

The two Pteropodidae species, with a medium to high risk of fatality are not expected to roost on the project site itself, as this environment is not expected to be their preferred habitat, but they could traverse over the project site during migration and are therefore included.

**Table 2: Potential bat species occurrence at the proposed Patatskloof WEF (Monadjem *et al.* 2010; IUCN, 2017).**

| Family | Species | Common Name | SA conserva-tion status | Global conserva-tion status (IUCN) | Roosting habitat | Functional group (type of forager) | Migratory behaviour | Likelihood of fatality risk* | Bats confirmed in vicinity |
|---|---|---|---|---|---|---|---|---|---|
| PTEROPODIDAE | *Eidolon helvum* | African straw-coloured fruit | Not evaluated | Least Concern | Little known about roosting behaviour | Broad wings adapted for clutter. Studies outside of South Africa list fruit and flowers in its diet. | Migrater. Recorded migration up to 2 518 km in 149 days, and 370 km in one night. | Medium-High | |
| | *Rousettus aegyptiacus* | Egyptian rousette | Least Concern | Least Concern | Caves | Broad wings adapted for clutter. Fruit, known for eating Ficus species. | Seasonal migration up to 500 km recorded. Daily migration of 24 km recorded. | Medium-High | |
| MINIOPTERIDAE | *Miniopterus natalensis* | Natal long-fingered bat | Near Threatened | Near Threatened | Caves | Clutter-edge, insectivorous | Seasonal, up to 150 km | High | ✓ |
| NYCTERIDAE | *Nycteris thebaica* | Egyptian slit-faced bat | Least Concern | Least Concern | Cave, Aardvark burrows, road culverts, hollow trees. Known to make use of night roosts. | Clutter, insectivorous; Avoid open grassland, but might be found in drainage lines | Not known | Low | |

| Family | Species | Common Name | SA conserva-tion status | Global conserva-tion status (IUCN) | Roosting habitat | Functional group (type of forager) | Migratory behaviour | Likelihood of fatality risk* | Bats confirmed in vicinity |
|---|---|---|---|---|---|---|---|---|---|
| MOLOSSIDAE | *Tadarida aegyptiaca* | Egyptian free-tailed bat | Least Concern | Least Concern | Roofs of houses, caves, rock crevices, under exfoliating rocks, hollow trees | Open-air, insectivorous | Not known | High | ✓ |
| | *Sauromys petrophilus* | Robert's Flat-headed bat | Least Concern | Least Concern | Narrow cracks, under exfoliating of rocks, crevices. | Open-air, insectivorous | | High | ✓ |
| RHINOLOPHIDAE | *Rhinolophus capensis* | Cape horseshoe bat<br>(endemic) | Near Threatened | Near Threatened | Caves, old mines. Night roosts used | Clutter, insectivorous | Not known | Low | |
| | *Rhinolophus clivosus* | Geoffroy's horseshoe bat | Near Threatened | Least Concern | Caves, old mines. Night roosts used | Clutter, insectivorous | | Low | ✓ (recorded on adjacent wind farm) |
| VESPERTILIO-<br>NIDAE | *Neoromicia capensis* | Cape serotine | Least Concern | Least Concern | Roofs of houses, under bark of trees, at basis of aloes | Clutter-edge, insectivorous | Not known | High | ✓ |

| Family | Species | Common Name | SA conserva-tion status | Global conserva-tion status (IUCN) | Roosting habitat | Functional group (type of forager) | Migratory behaviour | Likelihood of fatality risk* | Bats confirmed in vicinity |
|---|---|---|---|---|---|---|---|---|---|
| | Myotis tricolor | Temminck's myotis | Near Threatened | Least Concern | Roosts in caves, but also in crevices in rock faces, culverts, and manmade hollows | Limited information available | Not known | Medium-High | |
| | Eptesicus hottentotus | Long-tailed serotine (endemic) | Least Concern | Least Concern | Caves, rock crevices, rocky outcrops | Clutter-edge, insectivorous | Not known | Medium | ✓ |
| | Cistugo seabrae | Angolan wing-gland bat (endemic) | Vulnerable | Near Threatened | Possibly buildings, but no further information | Clutter-edge, insectivorous | Not known | Low | |

**Likelihood of fatality risk as indicated by the pre-construction guidelines (MacEwan et al., 2020)*

** Nycteris thebaica has been re-classified in Monadjem et al. (2020) and it is noted that Tadarida aegyptiaca will be split into more than one species, but for the purpose of this study, we conclude with the species as mentioned in the above table such.*

# 6. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

## 6.1 Static Recorders

Passive monitoring data for the period between 11 June 2021 and 27 June 2022 is included in this progress report. It is important to note that static recordings have limitations, as discussed in Section 2, but do provide a scientifically sound method of assessing the bat situation on the project site.

Although the systems on the Met mast were operational through the whole monitoring period, some data gaps on the 10 m masts were experienced, due to system failures, see **Table 3**. System H specifically had two periods of data loss, with a total gap of nearly six months. Although the ideal is a full set of data, this is often not achievable, but the number of systems deployed at Patatskloof WEF, combined with the uniformity of the biotope, is sufficient to make an informed decision of the bat situation at the project site based on the available data.

**Table 3: Gaps in the bat monitoring data.**

| Available Data | Gaps |
|---|---|
| 11 Jun 2021 - 4 Nov 2021 | 10m Mast (G):<br>11 Jun 2021 - 10 Jul 2021 |
| 5 Nov 2021 - 19 Jan 2022 | None |
| 20 Jan 2022 - 16 May 2022 | 10m Mast (H):<br>30 Apr 2022 - 16 May 2022 |
| 17 May 2022 - 27 Jun 2022 | 10m Mast (H):<br>17 May 2022 - 27 Jun 2022 |

## 6.2 Bat Species Diversity

Calls that sound like five of the 12 species that have distribution maps overlaying the proposed development site were recorded by the static recorders during the 12-month monitoring period, see Table 2 and Figure 16.

The data from the static recordings confirm the species distribution maps of the region. 81% of the calls of all the combined systems represent *Tadarida aegyptiaca*, see Figure 16, which is the dominant species on the project site. *T. aegyptiaca* is a high-risk species, physiologically adapted with a narrow wingspan to fly high, near the turbine blades. Due to this foraging preference, the risk of collision and barotrauma is high. Two more species have a significant presence: *Sauromys petrophilus* (10%) and *Neoromicia capensis* (8%). 1% of the species diversity was like that of the Near Threatened *Miniopterus natalensis*.

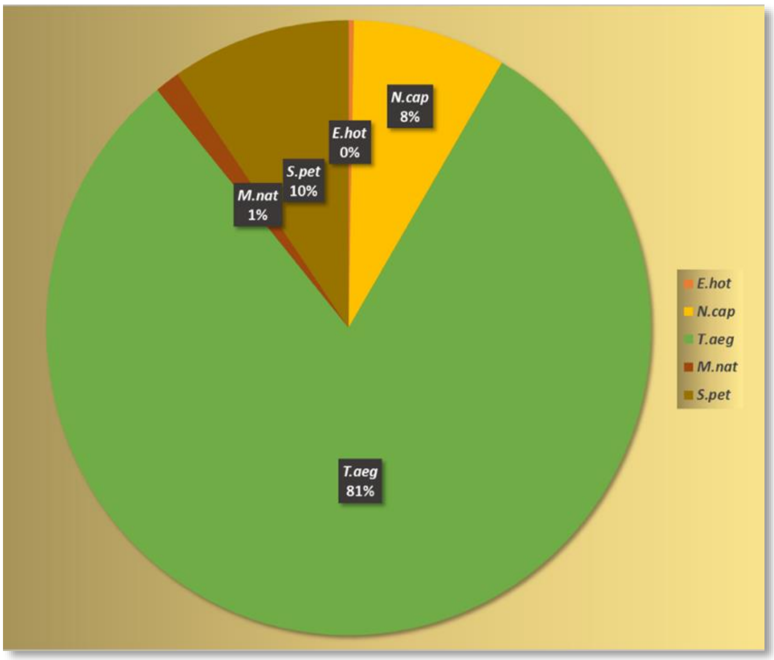



**Figure 16: Species diversity at the proposed Patatskloof WEF site**

Species diversity is often higher at lower altitudes, as can be observed in Figure 17. Although there are a similar number of species recorded at the lower systems, the percentage activity by species other than *T. aegyptiaca* is higher. At Patatskloof WEF, the Molossidae family is more dominant at the high-altitude systems, namely Systems A and B, with the Molossids *S. petrophilus* and *T. aegyptiaca* nearly comprising 100% of all the activity recorded at height (Systems A and B). Both these species are classified as high-risk species and one could therefore derive that Molossids run the highest risk of being killed by the turbine blades.

The rest of the calls represent *N. capensis, M. natalensis and E. hottentotus*. Although *T. aegyptiaca* depicts the highest activity at all monitoring stations, the above three species portray a higher proportion at the near ground masts, particularly close to the southern Bonteberg mountain range, represented by System G. Apart from the 19% of *N. capensis'* occurrence at the project site, it is worth noting that 2% of the activity recorded at this system was like that of the Near Threatened *M. natalensis.*

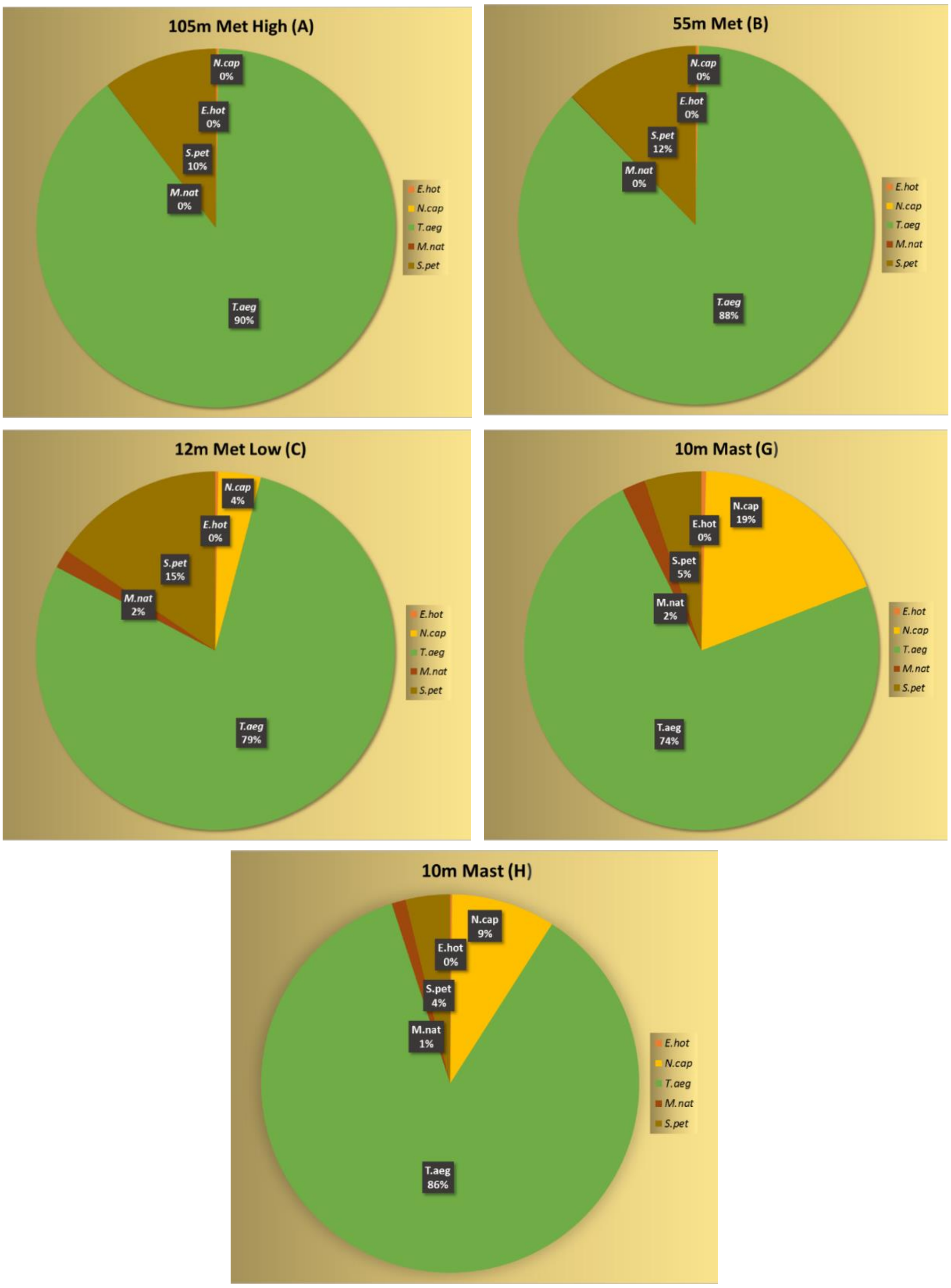



**Figure 17: Species diversity at Patatskloof WEF**

## 6.3 Species distribution over the monitoring period

Figure 18 portrays the weekly temporal distribution of bat passes over the monitoring period. The blue histogram depicts higher activity, indicating the activity of *T. aegyptiaca*. The activity starts to increase in September with a peak in October and a second, higher peak in February, and lasts until early autumn, around March. *S. petrophilus* mimics largely the activity pattern of *T. aegyptiaca,* although the activity is substantially lower than the latter. Low activity occurs from the end of March to the middle of August in autumn, with a very slight increase in the middle of May. In general, bat activity increases during warmer seasons, and according to the present data, this also is the case at Patatskloof WEF.

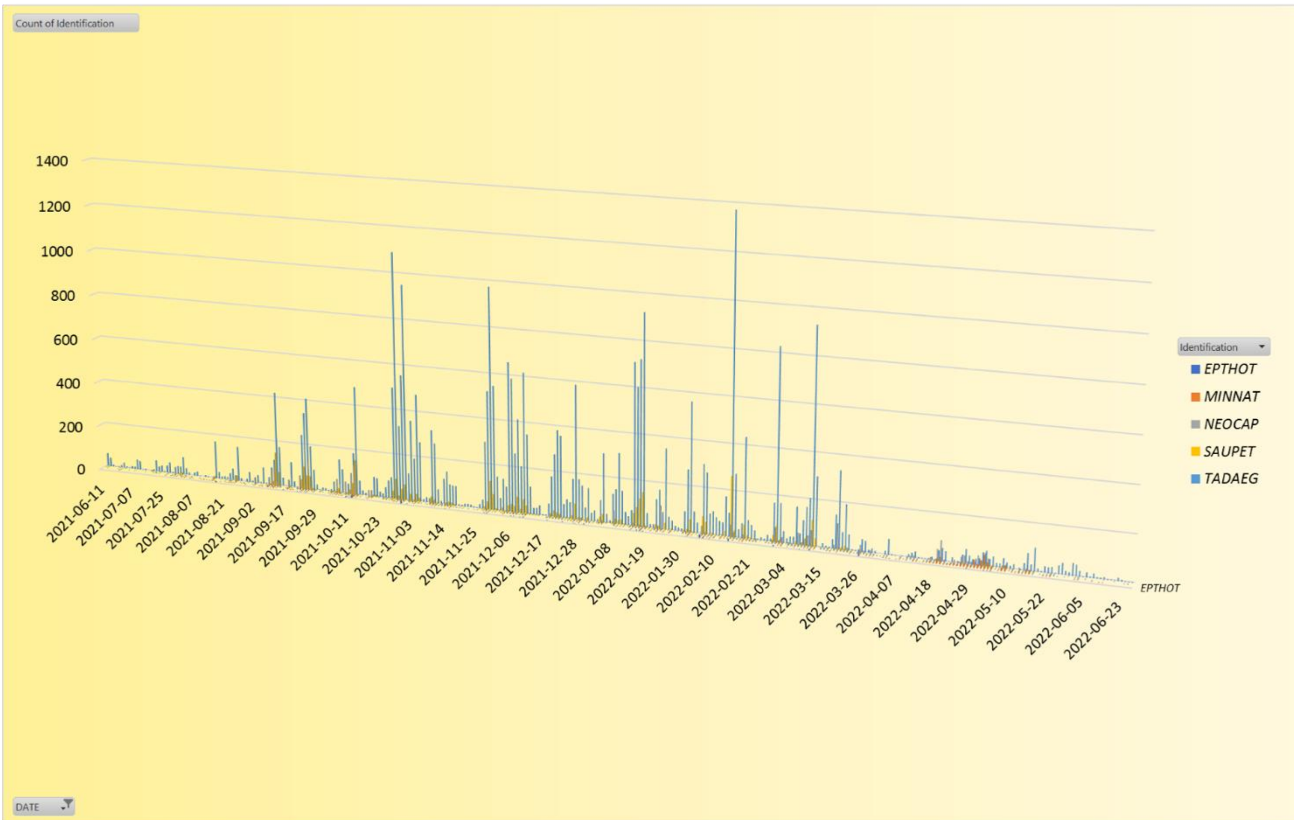



**Figure 18: Distribution of bat activity over the monitoring period**

Depicted in Figure 19 is the monthly average hourly bat passes, within the sweep of the turbine blades. This mirrors Figure 18, in that it too demonstrates the rapid increase in bat activity in the month of September. From December a gradual decrease in activity is experienced up to March after which a sharp decline can be seen towards April. Figure 18 demonstrates a bit of a decline in activity by *T. aegyptiaca* during November. Although there is no published information concerning the breeding of *T. aegyptiaca* in the Succulent Karoo, in other parts of the country, this species usually has their pups around November, and one could speculate that they hunt closer to their roost when the pups are young, therefore there is less activity recorded following the active spring period. Bats also tend to be more active when emerging from the cold winter months, especially if they have to increase food intake before pup season. Then one often experiences an increase in activity again before winter, in autumn, when they need to stock up for the winter months. Although there is not much of an increase in activity before winter, there is a bit of an increase in activity seen in May 2022.

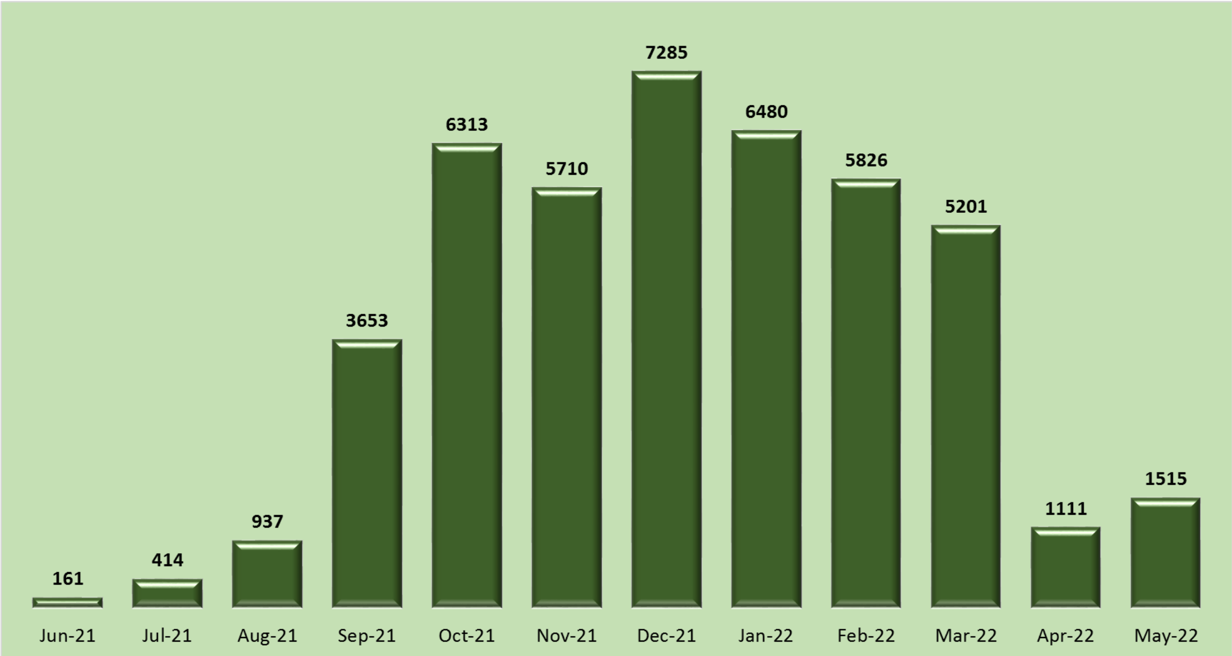



**Figure 19: Bat activity per month at the project site**

As can be seen in Figure 20, the seasonal activity is significantly higher during spring and summer if compared to autumn and winter.

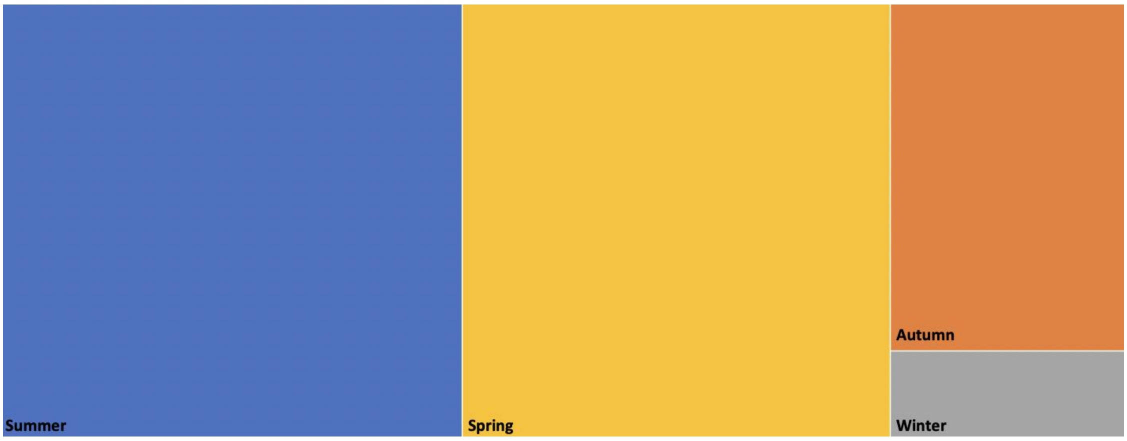



**Figure 20: Seasonal proportions of average bat activity.**

The bat activity at the two high sampling systems situated within the sweep of the proposed turbine blades over the monitoring year is depicted in Figure 21. This confirms the trend of high bat activity during spring and the first two months of summer, from September to March, with the first peak in October and the second peak in January. As expected, the 55 m sampling point (System B) recorded significantly higher activity than at 105 m (System A). Therefore, one would expect the lower section of the turbine sweep to be the most dangerous area for bats. Note that the slight decrease experienced at System B does not occur at System A.

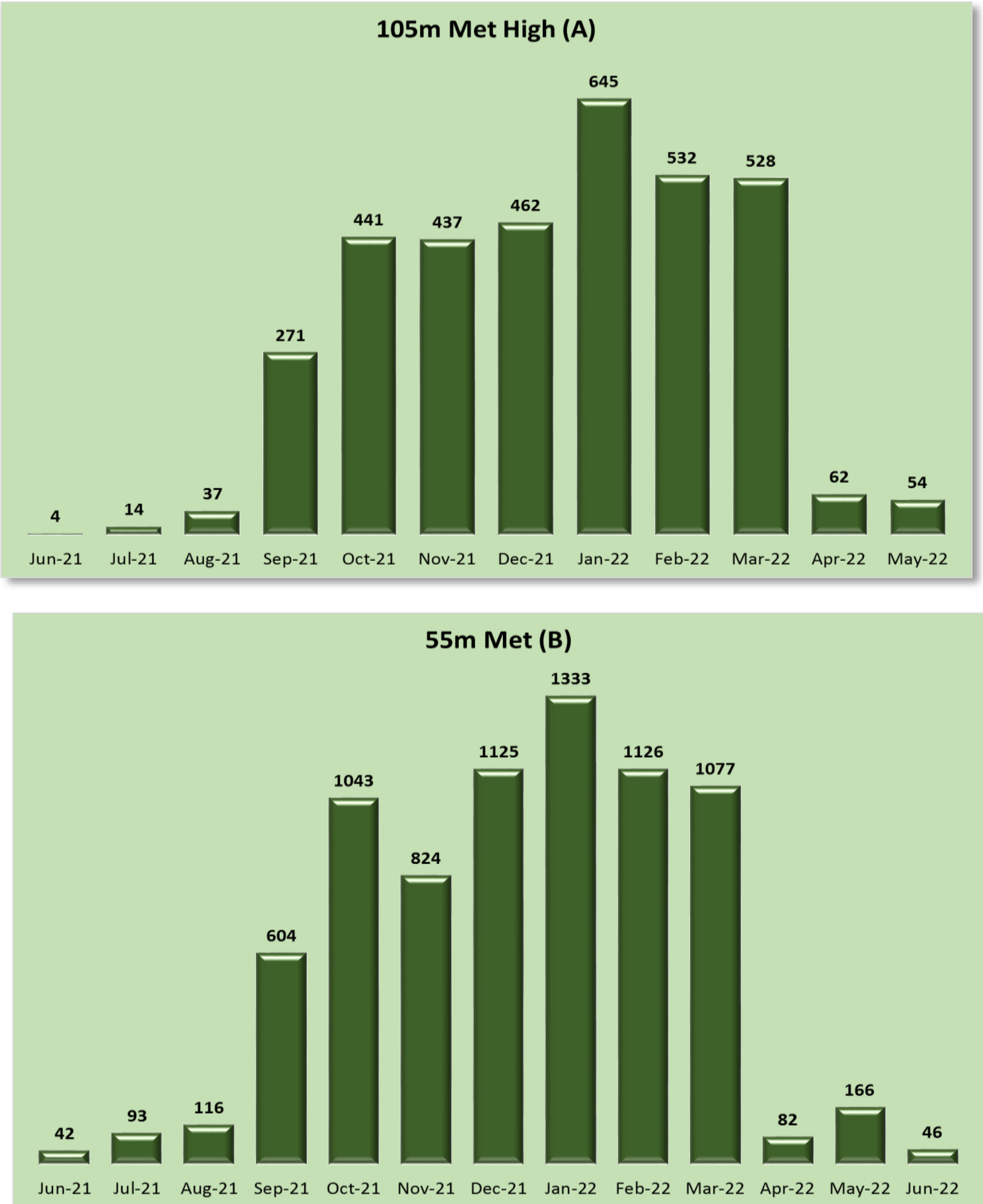



**Figure 21: Total bat activity at Met High (A) and Met (B) during the monitoring period**

## 6.4 Activity per monitoring station

Figure 22 depicts the median of each monitoring system. System C, the low sampling point on the Met mast, recorded the highest bat activity, with systems G and H portraying high bat activity. Data gaps at Systems H and G could have influenced the data, but it nevertheless shows that the near-ground activity is substantially higher than the activity recorded at height. The activity declines with altitude, with 12 m (System C) experiencing the highest activity, and 55 m, portraying lower activity. The lowest activity was evidenced at 105 m (System A). Not only is there a greater diversity of bat species at lower levels but also higher activity at lower altitudes. One could thus expect that bats recorded at Systems A and B are the ones that will experience the most severe negative impact from the proposed development.

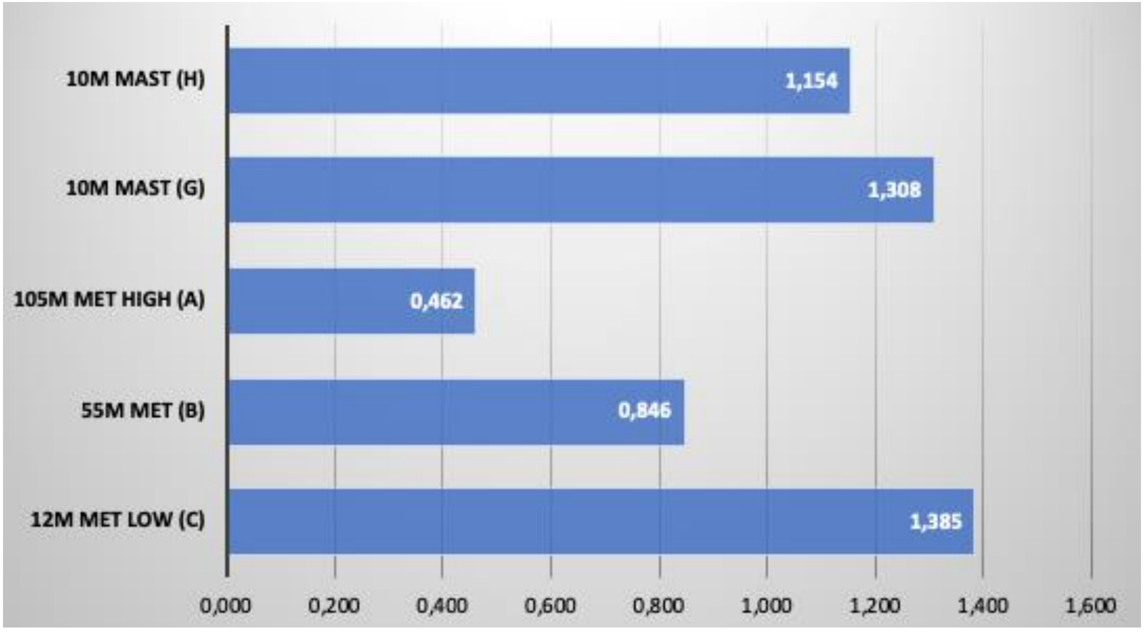



**Figure 22: Bat activity per monitoring station**

## 6.5 Species activity on the project site

Figure 23 depicts the bat activity of each species present, showing the activity at each monitoring system. The most abundant species, *T. aegyptiaca, S. petrophilus* and *N. capensis* are noted at the 10m Mast systems G and H, as well as at the 12 m Met Low system, System C.

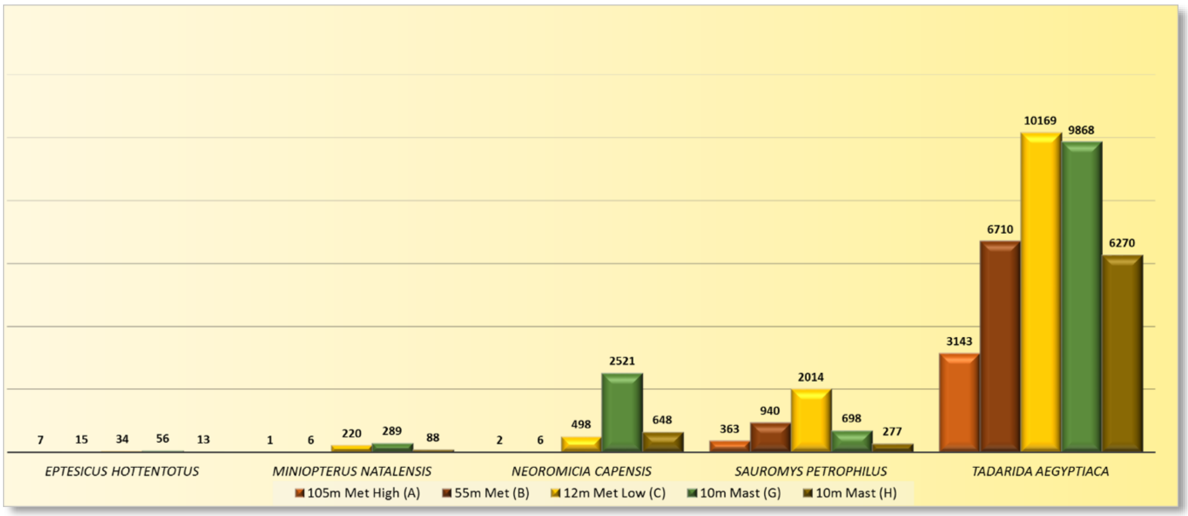



**Figure 23: Combined species activity per monitoring station**

Figure 24 depicts the median of hourly activity of the bat species recorded on the project site, showing the relatively high activity of *T. aegyptiaca*, followed respectively by *N. capensis*, *S. petrophilus,* the Near Threatened *M. natalensis* and the endemic *E. hottentotus*

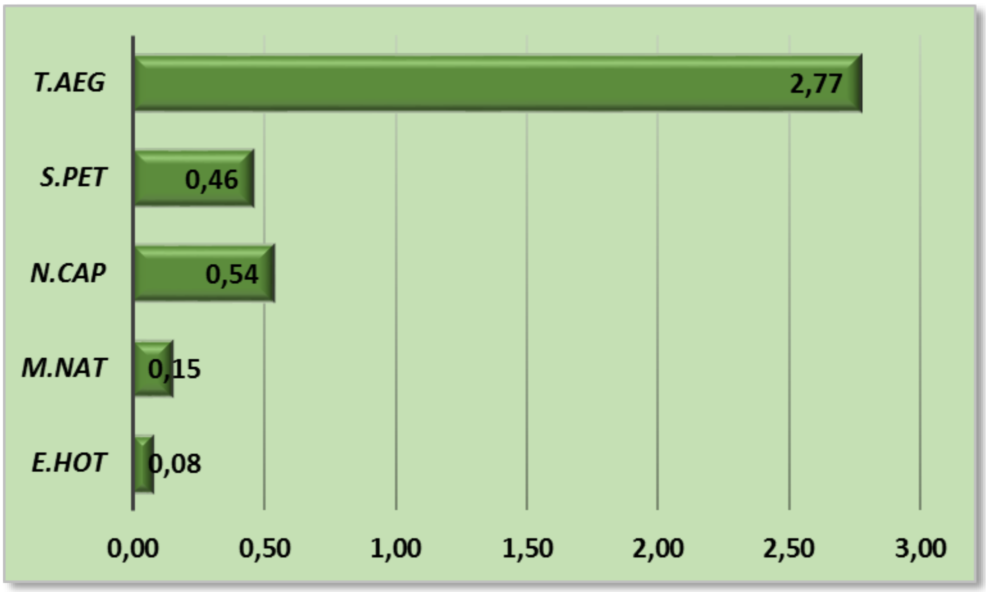



**Figure 24: Median of the hourly bat activity for the recorded bat species**

## 6.6 Nightly distribution of bat activity

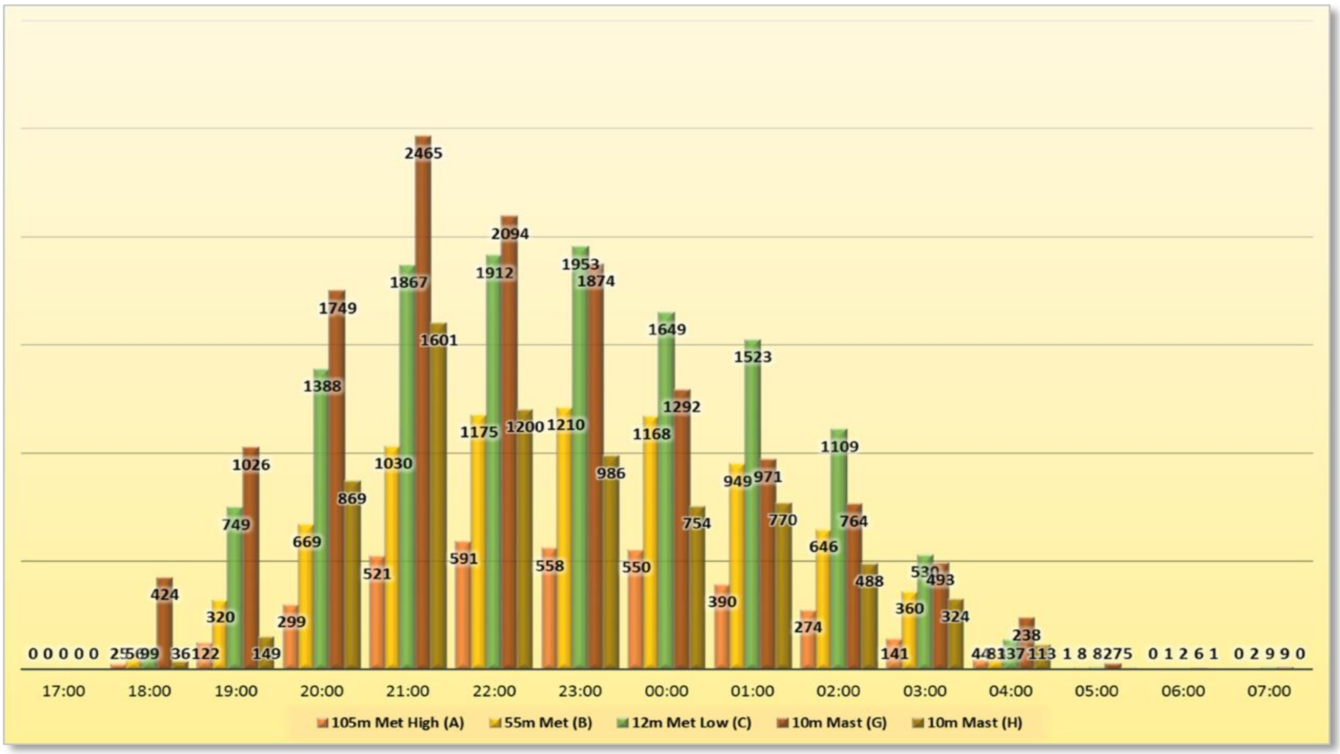



**Figure 25: Hourly bat activity per night for all the monitoring systems.**

Total hourly nightly bat activity for the monitoring period is portrayed in Figure 25. This figure provides insight into the general distribution of bat activity during each night, from sunset to sunrise. Note that with seasonal changes in sunset and sunrise, this graph will change, but it does provide a picture of the nightly distribution of bats.

In general, all the monitoring systems show a sharp increase in activity approximately two to three hours after sunset. Although there are differences in the peak hours of the various systems, all the systems follow the same general trend, with an increase in activity after sunset, peak activity between approximately 21:00 and 0:00, followed by a gradual decline in activity up to two to three hours before sunrise.

Monitoring systems A and B basically tend to follow the same trend where overall there is an increase in bat activity until the peak at 22:00 for systems A and at 23:00 for System B. The peak in activity is the same for monitoring Systems G and H at 21:00, while the peak at system C takes place around 23:00, which is the same as System B. The reason could be that System C is situated 42 m below System B on the Met mast and although System B recorded less activity, the bat activity might portray the same characteristics.

These patterns are of importance if mitigation measures are to be developed, as they indicate the most active periods during the night, specifically when the hourly activity at 105 m (A) and 55 m (B) within the sweep of the proposed turbine blades are observed, see Figure 26. Although activity at B is higher than at A, the trend is similar, with a sharp increase in activity after sunset until 21:00, followed by peak activity hours, a gradual decline in activity towards midnight followed by a sharp decline in activity until sunrise.

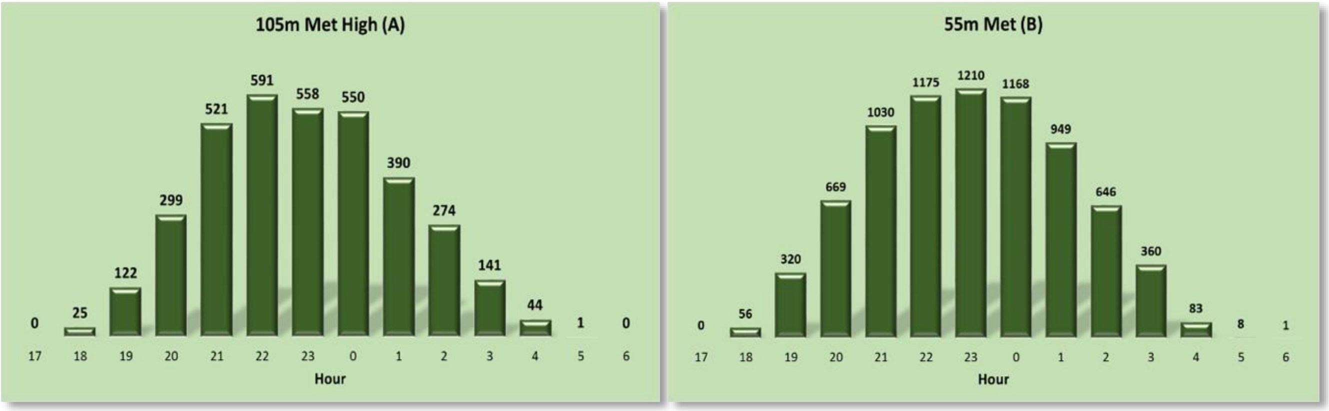



**Figure 26: Hourly bat activity per night at systems A and B**

## 6.7 Bat threshold at Patatskloof WEF

The South African Bat Fatality Threshold (MacEwan *et al*., 2020) and the South African Bat Best Practice Guidelines (MacEwan *et al*., 2020) report results from early operational facilities in South Africa that show a linear increase in bat fatalities as more turbines are monitored. Threshold guidelines are calculated based on proportional bat occupancy per hectare for each of South Africa's terrestrial ecoregions to predict and assess cumulative impacts on bat fatalities as new WEFs are constructed. These biomes and ecoregions are identified by diverse biodiversity patterns determined by climate, vegetation, geology, and landforms (Dinerstein *et al*., 2017; Olson *et al*., 2001). Threshold calculations add natural population dynamics and bat losses due to anthropogenic pressures to the sum to gauge the number of bat fatalities that may lead to population decline. Error! Reference source not found. below indicates the height-specific bat activity and fatality risk according to the South African bat threshold guidelines (MacEwan *et al*., 2018). It also includes the median of hourly bat activity at height over the monitoring period, from systems A and B, and near ground level, from systems C, G and E. For ground level as well as within the rotor sweep area, the risk category is high, and the proposed

Patatskloof WEF's bat activity is way above the highest bat fatality threshold for bats in the Succulent Karoo. According to the bat threshold guidelines, fatality minimisation measures should be recommended during pre-construction, and should be applied from the commencement of turbine rotation.

**Table 4: The bat fatality risk threshold for Succulent Karoo with the median from within the sweep of the proposed turbine blades and from lower near ground monitoring systems (MacEwan et al., 2018)**

| Ecoregion | Height category* | Low Risk (Median bat passes/ hour) | Medium Risk (Median bat passes/ hour) | High Risk (Median bat passes/ hour) |
|---|---|---|---|---|
| **Succulent Karoo** | Near ground | 0.00 | > 0.00 - 0.20 | > 0.20 |
| | Rotor sweep | 0.00 | > 0.00 - 0.03 | > 0.03 |

| Height of monitoring systems at Patatskloof WEF | Median of hourly bat activity for the monitoring period |
|---|---|
| Combined activity from 105 m (A) and 55 m (B) in the rotor sweep area | 0,40 |
| Combined activity from 10 m systems (D, G, H) near ground. | 0,83 |

## 6.8 Weather conditions and bat activity

The information provided in this section describes the relationship between weather conditions and bat activity, in particular activity within the rotor swept area of the turbine blades. Weather conditions, especially temperature, wind, and humidity, have an influence on bat activity. Literature (Arnett *et al*., 2008; Baerwald *et al*., 2009; Kunz *et al*., 2007), as well as observations from personal experience, indicate that bats tend to be more active at lower wind speeds and higher temperatures. Therefore, bats tend to be more active during warm, quiet nights, combined with elevated humidity; especially when there is an abundance of food, such as termites. Higher activity has also been reported during dark moon. Lower monitoring systems follow the same pattern to a large extent, but as weather monitors are close to the high microphone, and the high microphone is within the rotor swept area of the turbine blades, this system provides more accurate data to plot with the weather data. This data is used to compile a mitigation schedule for sensitive areas to be implemented from the onset of operation of the WEF. The curtailment schedule is used in conjunction with data from the monitoring systems from the adjacent proposed WEFs to refine mitigation strategies.

Weather data from the Met mast were correlated with bat data from Systems A and B and were used for the statistical analyses detailed below, as these sampling systems are situated within the area of collision. This data was used to inform the mitigation measures. Statistical analysis between weather and bat activity was also conducted with systems C, G and H combined. This near-ground data did not inform the mitigation measures, as the only available weather data is from the Met mast and the weather data were taken too far from the near-ground bat monitoring sampling points. These data were only considered to confirm trends on the project site as a whole. See Appendix 1 for weather distribution graphs wherein the number of nights was plotted against wind speed, temperature, and humidity. The following weather data from the Met mast was used:

- Temperature data from 140 m and 50 m;
- Wind data from 100 m and 50 m; and
- Humidity data from 140 m and 50 m.

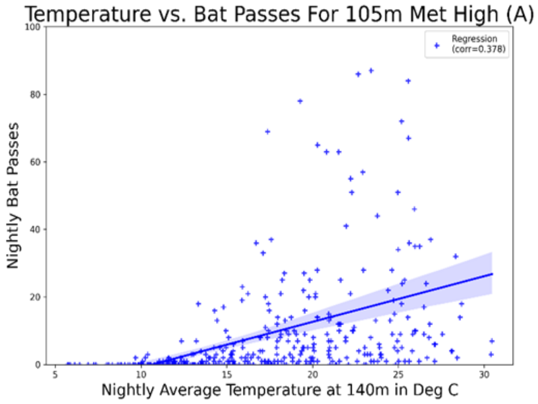
## 6.9 Linear Regression

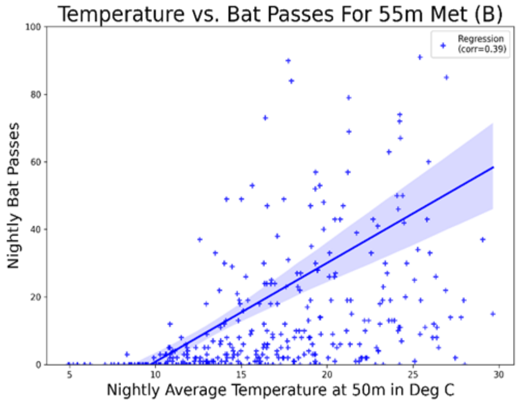
Results of a linear regression between weather conditions and bat activity are provided in Figure 27 and summarised in Table 4. The linear regressions sometimes result in inadequate variation due to the small sample size of bat data from the monitoring systems (A and B, as well as C, G and H combined) for 12 months. In addition, bats are not necessarily active during various weather conditions. It nevertheless provides an indication as to the positive or negative relationship between weather conditions and bat activity. As soon as more data is available during post-construction, linear regression analyses should be applied to the data again.

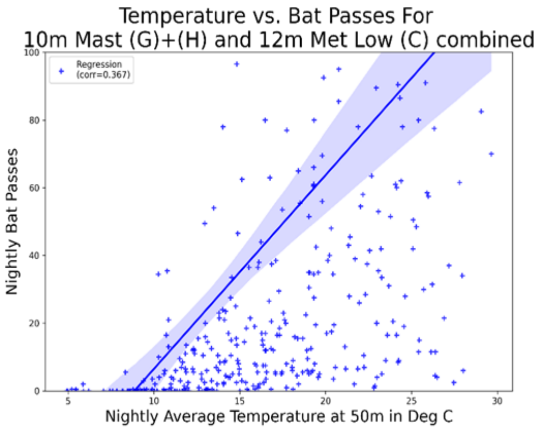
**Table 5: Summary of linear regression**

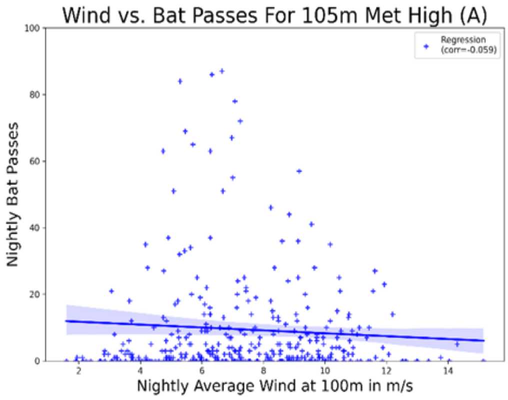
| | Correlation Coefficient | |
|---|---|---|
| Temperature vs. Bat activity at Met High (A) | 0.378 | A positive relationship between temperature and bat activity. As temperature increases, so does the bat activity. |
| Wind vs. Bat activity at Met High (A) | -0.059 | Very weak negative relationship between wind speed and bat activity. As wind speed increases, the bat activity decreases slightly. |
| Humidity vs. Bat activity at Met High (A) | -0.053 | Very weak negative relationship between humidity and bat activity. As humidity increases, the bat activity decreases slightly. |
| Temperature vs. Bat activity at 55 m Met (B) | 0.39 | Positive relationship between temperature and bat activity. As temperature increases, so does the bat activity. |
| Wind vs. Bat activity at 55 m Met (B) | -0.058 | Very weak negative relationship between wind speed and bat activity. As wind speed increases, the bat activity decreases slightly. |
| Humidity vs. Bat activity at 55 m Met (B) | -0.062 | Very weak negative relationship between humidity and bat activity. As humidity increases, the bat activity decreases slightly. |

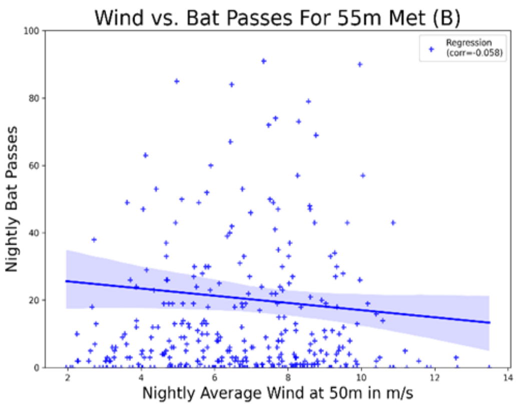
| | Correlation Coefficient | |
|---|---|---|
| Temperature vs. Bat activity at 10 m Mast (G)+(H) and 12 m Met Low (C) combined | 0.367 | Positive relationship between temperature and bat activity. As temperature increases, the bat activity increases. |
| Wind vs. Bat activity at 10 m Mast (G)+(H) and 12 m Met Low (C) combined | -0.087 | Weak negative relationship between wind speed and bat activity. As wind speed increases, the bat activity decreases. |
| Humidity vs. Bat activity at 10 m Mast (G)+(H) and 12 m Met Low (C) combined | -0.056 | Weak negative relationship between humidity and bat activity. As humidity increases, the bat activity decreases slightly. |

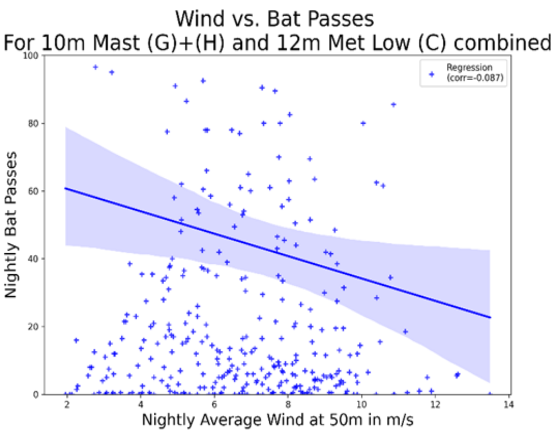

Temperature vs. Bat Passes For 105m Met High (A)
Regression (corr=0.378)
Nightly Bat Passes
Nightly Average Temperature at 140m in Deg C


Temperature vs. Bat Passes For 55m Met (B)
Regression (corr=0.39)
Nightly Bat Passes
Nightly Average Temperature at 50m in Deg C


Temperature vs. Bat Passes For
10m Mast (G)+(H) and 12m Met Low (C) combined
Regression (corr=0.367)
Nightly Bat Passes
Nightly Average Temperature at 50m in Deg C


Wind vs. Bat Passes For 105m Met High (A)
Regression (corr=-0.059)
Nightly Bat Passes
Nightly Average Wind at 100m in m/s


Wind vs. Bat Passes For 55m Met (B)
Regression (corr=-0.058)
Nightly Bat Passes
Nightly Average Wind at 50m in m/s


Wind vs. Bat Passes
For 10m Mast (G)+(H) and 12m Met Low (C) combined
Regression (corr=-0.087)
Nightly Bat Passes
Nightly Average Wind at 50m in m/s

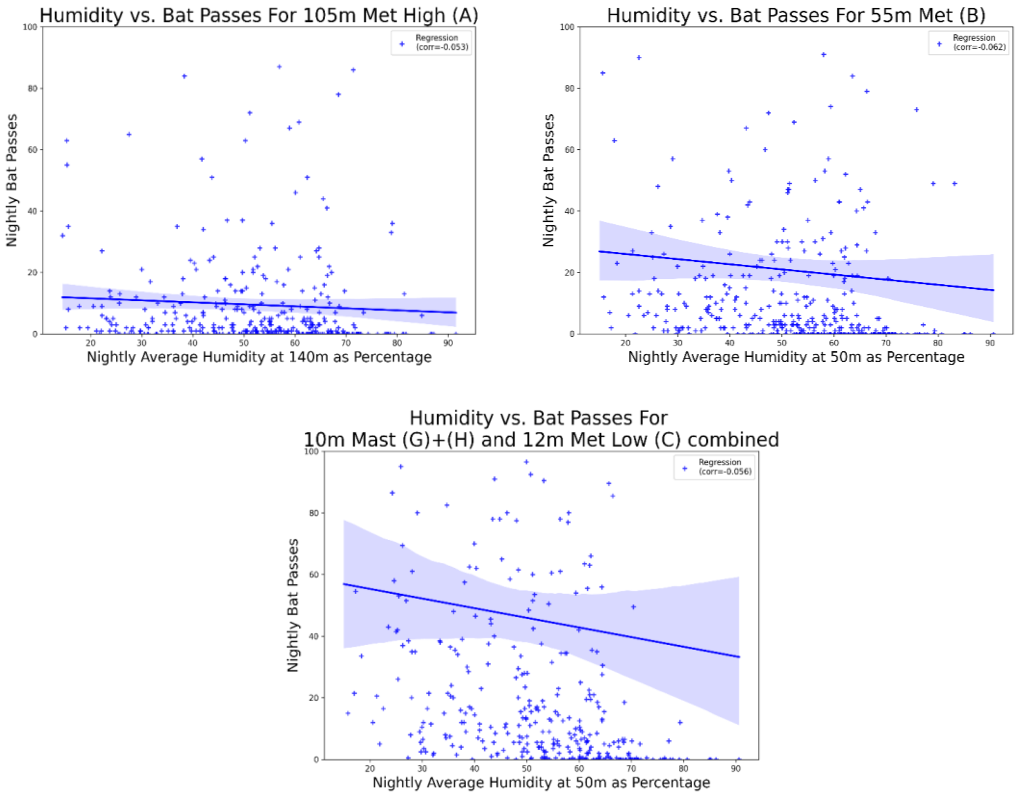



**Figure 27: Linear regression of temperature, wind speed and humidity as predictors of the distribution of bat activity**

## 6.10 Cumulative distribution functions (CDF)

Figure 28 illustrates the cumulative distribution functions, where cumulative means an increased quantity by successive additions, wherein cumulative bat activity is plotted with temperature, wind speed and humidity data.

The cumulative percentages at 105 m Met High (A) indicate the following results:

- Nearly 100% of the bat activity was recorded above 10 ℃;
- Approximately 80% of the bat activity was recorded below 8.7 m/s wind speed, with 90% of the activity occurring below 9.7 m/s; and
- Approximately 80% of the bat activity was recorded between 40% and 70% humidity.

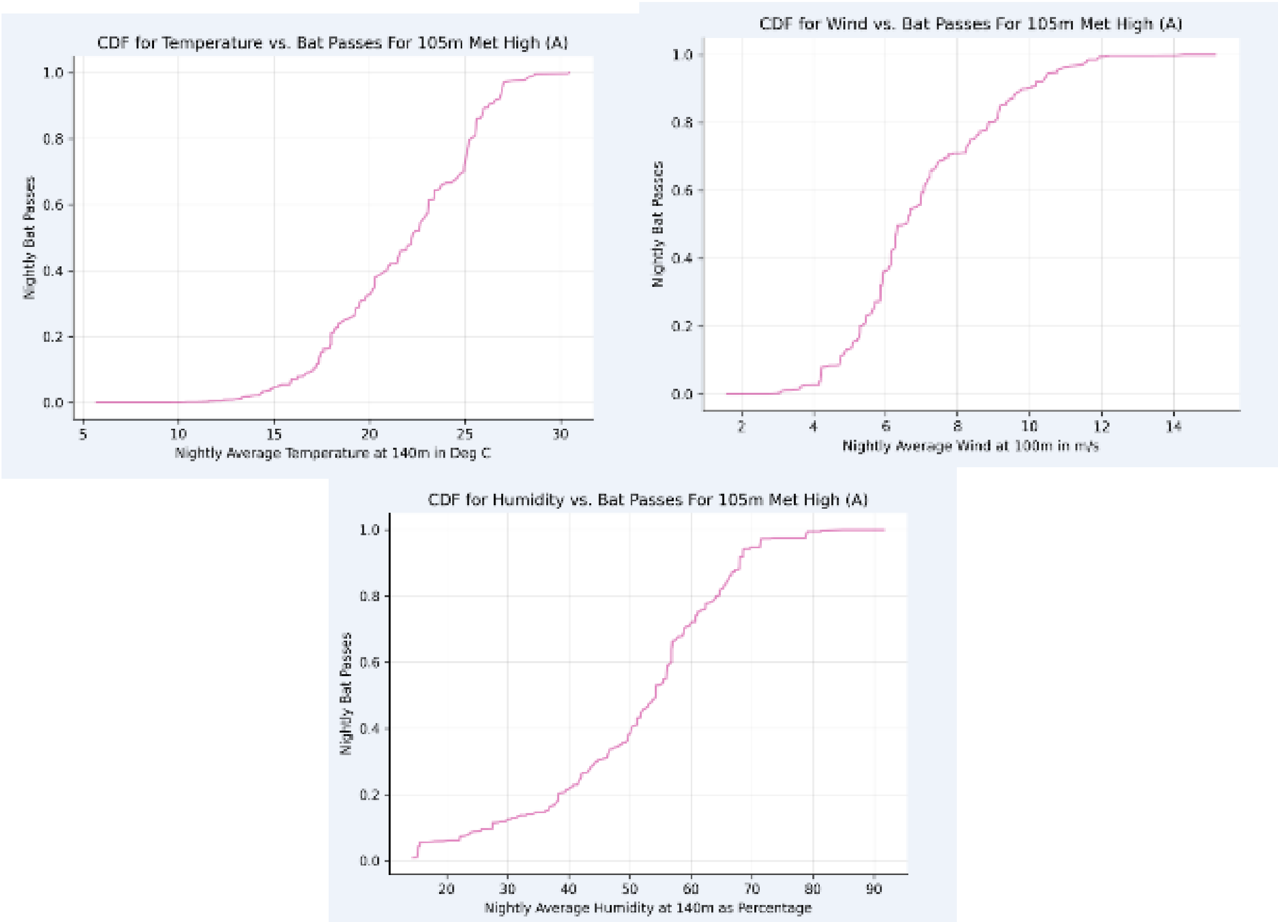



**Figure 28: Cumulative distribution function for weather and bat activity at System A, 105 m on the Met mast**

The cumulative percentages depicted at 55 m Met (B) (Figure 29) indicate the following results:

- Nearly 100% of the bat activity was recorded above 10 ℃;
- Approximately 80% of the bat activity was recorded below 8.1 m/s wind speed; and
- Approximately 80% of the bat activity was recorded between 40% and 70% humidity.

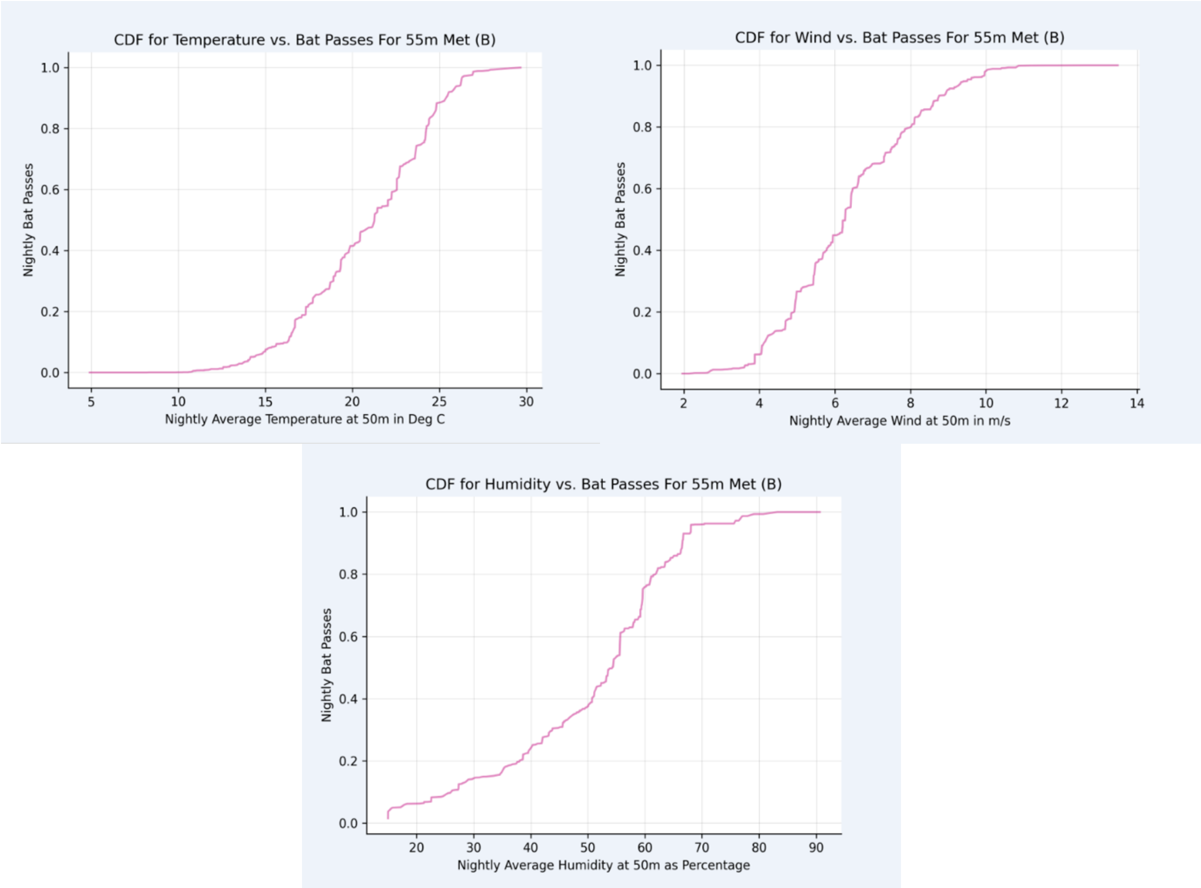



**Figure 29: Cumulative distribution functions for weather and bat activity at System B, 55 m on the Met mast**

The cumulative percentages at 10 m Mast (G), 10 m Mast (H) and 12 m Met Low (C) combined, as depicted in Figure 30, indicate the following results:

- Nearly 100% of the bat activity was recorded above 10℃;
- Approximately 80% of the bat activity was recorded below 8 m/s wind speed, with most activity below 10 m/s; and
- Approximately 65% of the bat activity was recorded between 40% and 70% humidity.

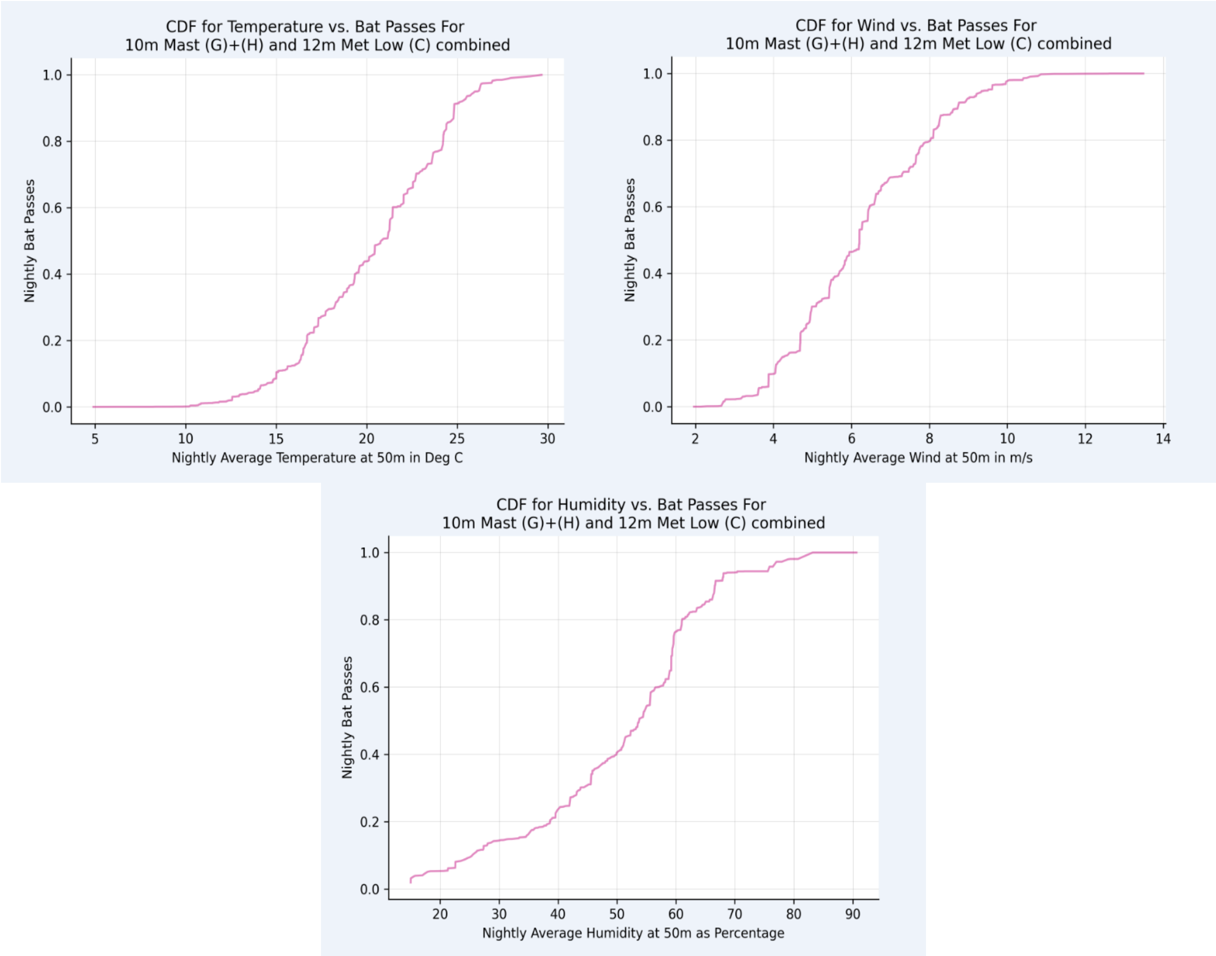



**Figure 30: Cumulative distribution functions for weather and bat activity at combined near ground systems C, G and H**

Cumulative Distribution Function (CDF) heat maps provide a better visualisation of the concentration of bat activity when plotted with weather conditions and confirm the results from the previous Section 6.8. Darker areas indicate a concentration of activity.

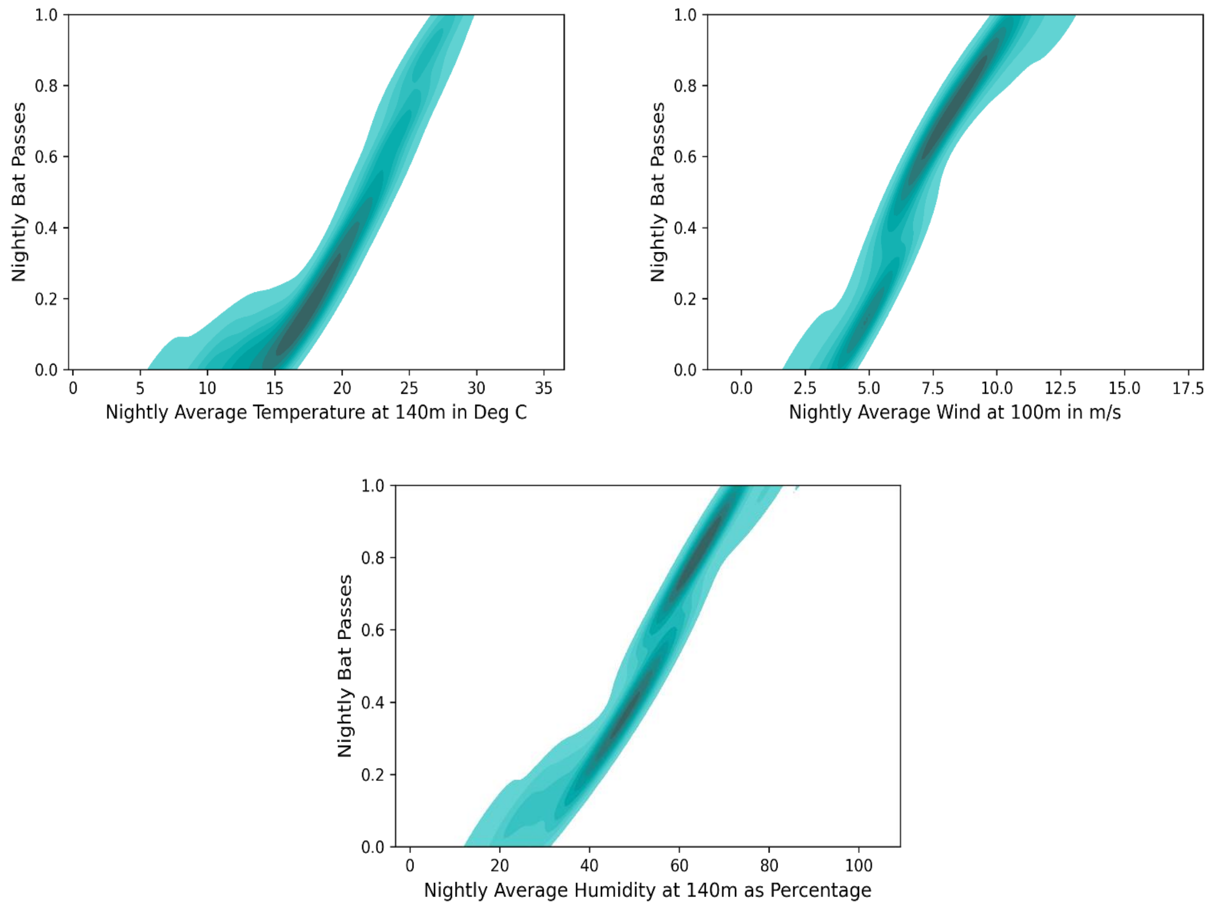



**Figure 31: CDF heat maps showing weather and bat activity at the 105 m (System A) on the Met mast**

The density of bat passes at certain temperatures, wind speed ranges and humidity ranges for the 105m Met High (System A) can be clearly observed when CDF heat maps are plotted. As indicated in Figure 31, the following could be derived:

- Nightly average activity and temperature: A concentration of bat activity occurred around 18.0 °C, but activity density is observed as high as 28 °C;
- Nightly average activity and wind speed: A concentration of bats occur below 8.25 m/s, with most bats being active below 11 m/s; and
- Nightly average activity and humidity: Bat activity at Patatskloof shows pockets of concentration above 38% humidity.

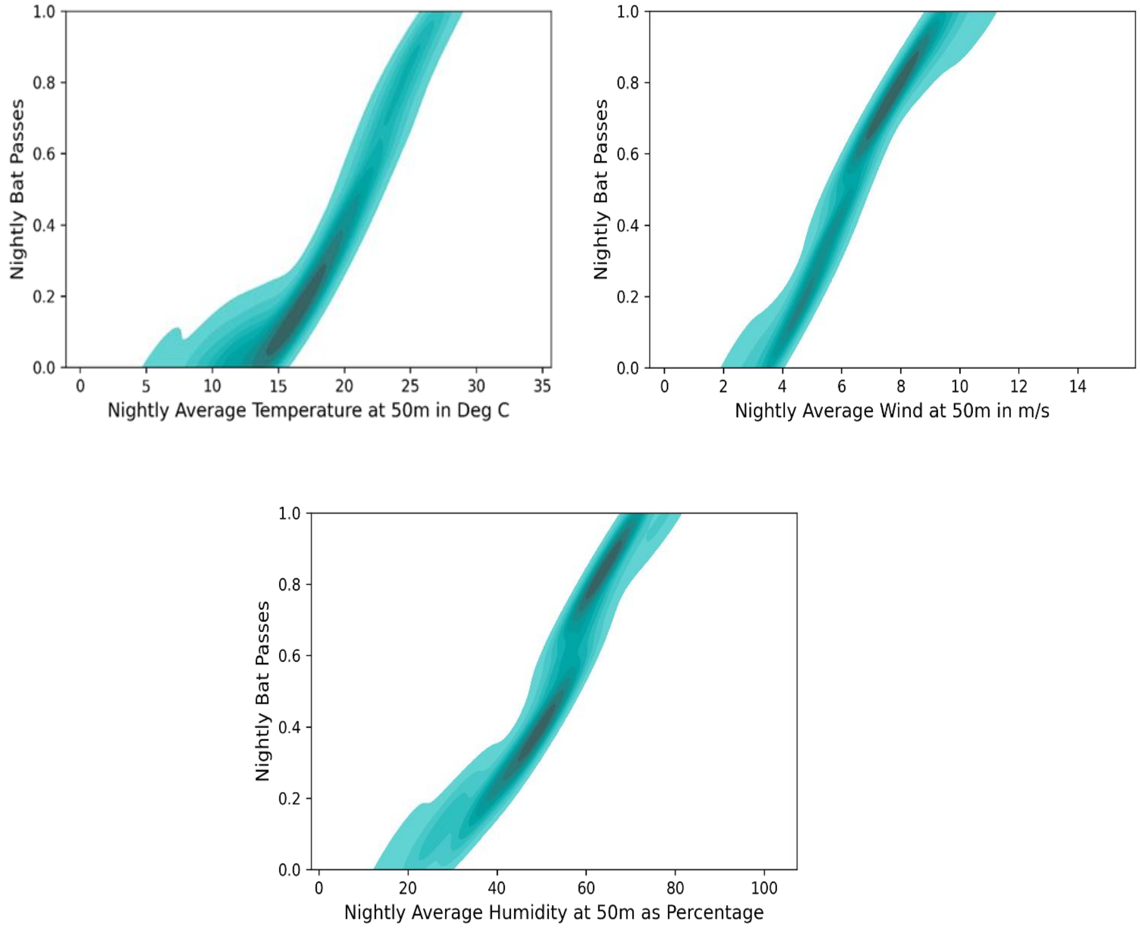



**Figure 32: CDF heat maps showing weather and bat activity at the 55 m (System B) on the Met mast**

The density of bat passes at certain temperatures, wind speed ranges and humidity ranges for 55 m Met (B) can be clearly observed when CDF heat maps are plotted. As indicated in Figure 32, the following could be derived:

- Nightly average activity and temperature: A concentration of bat activity occurred around 17.0°C, but activity density is observed as high as 28 °C;
- Nightly average activity and wind speed: A concentration of bats occur below 8 m/s, with most bats being active below 9 m/s; and
- Nightly average activity and humidity: Bat activity at Patatskloof shows pockets of concentration above 38% humidity

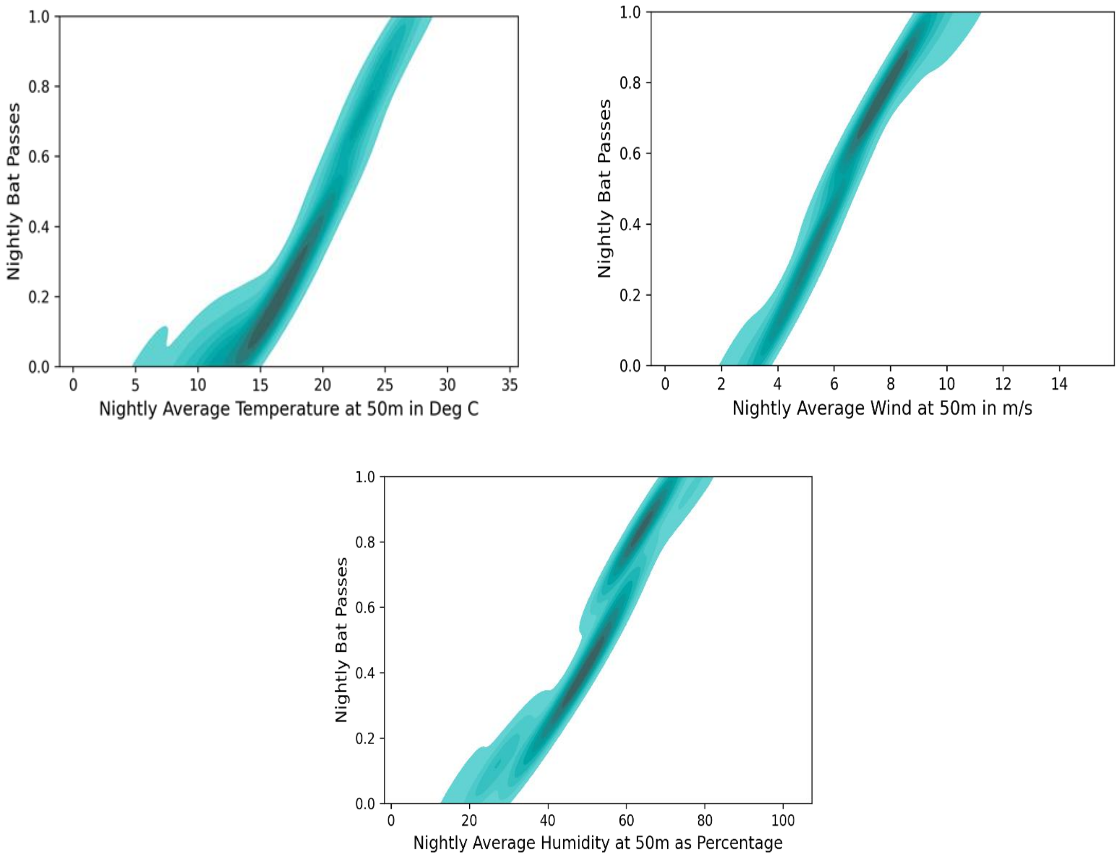



**Figure 32: CDF heat maps showing weather and bat activity at combined near ground systems C, G and H**

The density of bat passes during certain temperatures, wind speed ranges and humidity for 10 m Mast (G), 10 m Mast (H) and 12 m Met Low (C) combined can be clearly observed when CDF heat maps are plotted and from Figure 33, the following could be derived:

- Nightly average activity and temperature: A concentration of bat activity occurred around 18$^{o}$C, but activity density is observed as high as 27 $^{o}$C;
- Nightly average activity and wind speed: A concentration of bats occur below 7.8 m/s, with most bats being active below 10 m/s; and
- Nightly average activity and humidity: Bat activity at Patatskloof shows pockets of concentration above 45% humidity.

## 6.11 Transects

Transects are a snapshot in time but do confirm species present at the project site. Transects at the WEF site were conducted during seasons when high bat activity was expected. The transects were conducted with SM4BAT and a SMMU2 microphone mounted on a pole on the vehicle, see Figure 3. Within the profession, the value of transects is debated at present. However, two seasonal transects were conducted, one during cold weather conditions and one when the weather conditions were already warmer.

Starting at sunset up to approximately two hours after sunset, the vehicle was driven at a speed between 10 to 20 km/h along a set route. A SM4 GPS was linked to the detector so that the route was recorded while driving. The detector was calibrated at the start of each transect and weather conditions were recorded.

Bat calls were plotted with MayotisSoft to show the positions where bats were recorded on the transect route in November when high bat activity was recorded. Note that when bats were recorded close to one another, individual calls are plotted on top of each other and are not clearly displayed on the map, see Figure 34. One could nevertheless establish where high bat activity was recorded.

Table 6 depicts transect results. Although September is officially spring, the weather conditions were still cold, and this transect was therefore classified as wintertime. An extra section of road, where high bat activity was expected, was driven during the November transects. One bat was recorded during the two transects in winter, while a total of 148 bats were recorded during the November transect. 80 bat passes were recorded on the set route, while another 68 bat passes were recorded on the extra section. The November transects showed an exceptionally high bat activity recorded during a transect. Bats were recorded all along the transect route, showing an even distribution of bat activity all over the project site during this transect. The transect mirrors the high activity recorded during springtime at the stationary monitoring systems. Of importance is the high activity of *Sauromys petrophilus* (Robert's flat-headed bat), which was the second most recorded species on the transect. This bat species seems to be sometimes relatively more active on the project site than was portrayed by the stationary systems.

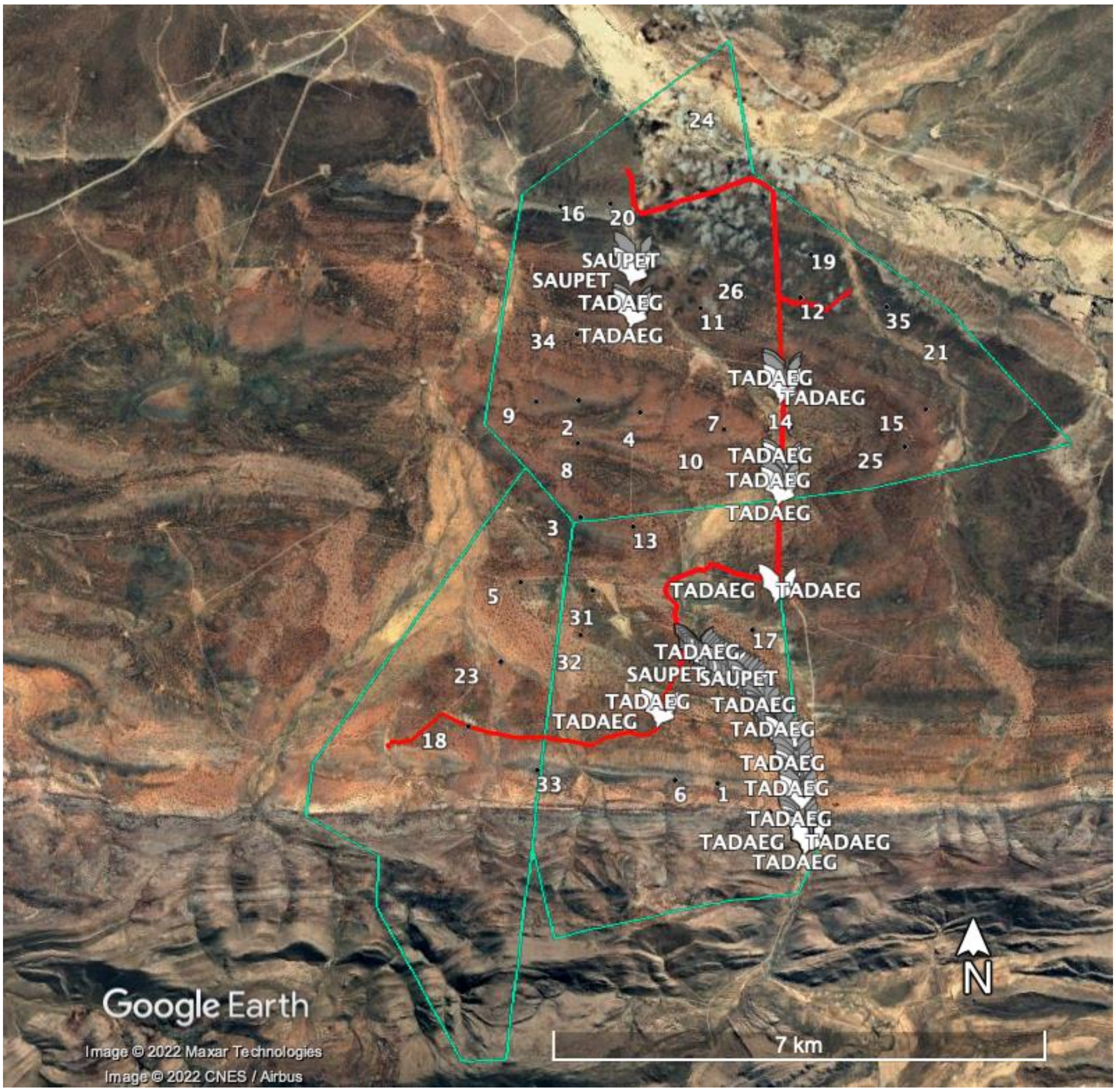



**Figure 33: Transect results of 3 November 2021, showing high bat activity**

**Table 6: Patatskloof WEF transect results**

| Date | Temperature | Weather | Wind | Results |
|---|---|---|---|---|
| *Winter* | | | | |
| 1 September 2021 | 11 °C | Partly cloudy | Between 1,6 m/s and 3,3 m/s | 1 X *T. aegyptiaca* |
| 2 September 2021 | 8 °C | Cloudy | Between 3,4 m/s and 5,5 m/s | No bat calls |
| *Spring (with extra road section)* | | | | |

| | | | | |
|---|---|---|---|---|
| 3 November 2021 | Between 18 °C and 21 °C | Clear | 0,9 m/s to 1,6 m/s | 78 X *T. aegyptiaca*<br>2 x *S. petrophilus* |
| Extra section of road added to the transect | | | | 44 X *T. aegyptiaca*<br>19 X *S. petrophilus*<br>1 x *N. capensis* |

# 7. BAT SENSITIVITY MAP

Sensitivity zones are based on buffer zones, as indicated by the *South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction* (MacEwan, *et al*. 2020). These zones are refined through field visits when physically visiting the bat-conducive environments occurring at the development sites, as well as static and active monitoring data.

The minimum buffer recommendation from SABAA is a 200 m buffer around all potentially bat-important features. Figure 35 has therefore incorporated 200 m buffers as a minimum. Due to the high bat activity at the project site, larger buffers have been applied to some high sensitivity zones at the proposed Patatskloof WEF project site.

Sensitivity zones are relevant to all components of the turbines, including the tips of the turbine blades; therefore, should a turbine be installed within proximity to a medium sensitivity zone and the turbine tip encroaches the medium sensitivity zone, then the mitigation of the medium zone should be applied to that turbine. Should the tip fall in a 'no-go' area or a high bat sensitivity zone, the turbines should be shifted out of that zone. it is recommended that these areas constitute 'no-go' development areas, i.e., where turning turbine components are not allowed. Medium sensitivity zones could be developed (turbines and associated infrastructure), but with mitigation.

## 7.1 'No-go' zones

'No-go' zones are areas in which development should be avoided at all costs, not only for turbine placement but as far as possible also for laydown areas and other supporting infrastructure, with the exception of roads. 'No-go' zones are recommended for the following:

- The northern section of the wind energy site, with mountainous areas and many roosting opportunities for bats;
- Dry riverbeds with historical riparian shrub;
- 500 m buffer 'no-go' area around human dwellings; and
- 200 m buffer 'no-go' area around water sources, including water troughs for livestock, reservoirs, dams, and some clumps of isolated trees.

Some of these features could be historic, and might not present riparian shrubs at present, but the precautionary principle is valid for periods with increased rainfall, as per the bat guidelines.

## 7.2 High sensitivity zones

It is recommended that high sensitivity zones should be avoided for turbine development, but components of supporting infrastructure could occur in these areas if no bat roosts are disturbed. The following are included in high sensitivity zones:

- Areas between no-go zones which could serve as flight corridors.

## 7.3 Medium sensitivity zones

It is recommended that medium sensitivity zones are kept free from development as far as possible but could be developed with mitigation measures. These zones are as follow:

- Areas of vegetation which are conducive to bat activity.
- Areas surrounding high sensitivity areas. This is to protect bats that fly, for example, beyond their roost area.
- Areas which could be sensitive to bats, but do not need a no-go or high sensitivity classification.

## 7.4 Low sensitivity zone

When considering the high bat activity at the proposed Patatskloof WEF according to the threshold classification for Succulent Karoo (see Section 6.1.3), there are no low sensitivity areas on Patatskloof WEF. Low sensitivity is therefore considered relevant to the project site itself. These areas could be developed without turbine-specific mitigation at this stage of the project, although the mitigation measures for the project site, as described above, must be implemented. Because of the high bat activity recorded, the developer should budget for mitigation such as bat deterrents or curtailment, so that specific turbines could be targeted for operational mitigation when more data is available.

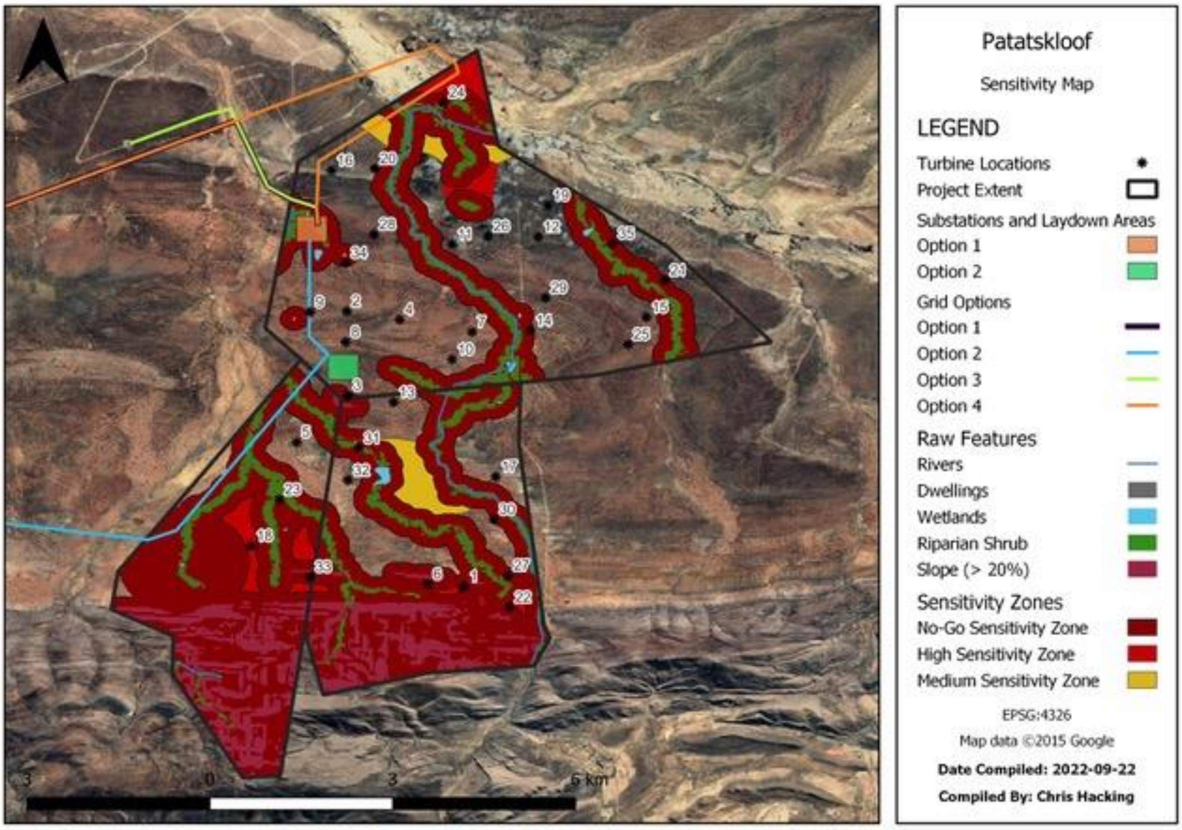



**Figure 34: Bat sensitivity map for the proposed Patatskloof WEF site**

## 7.5 Updated bat sensitivity map

After specialist input was considered, the developer is proceeding with a buildable area instead of a detailed turbine layout. An updated bat sensitivity map is provided in Figure 35 with no further infringement of turbine positions.

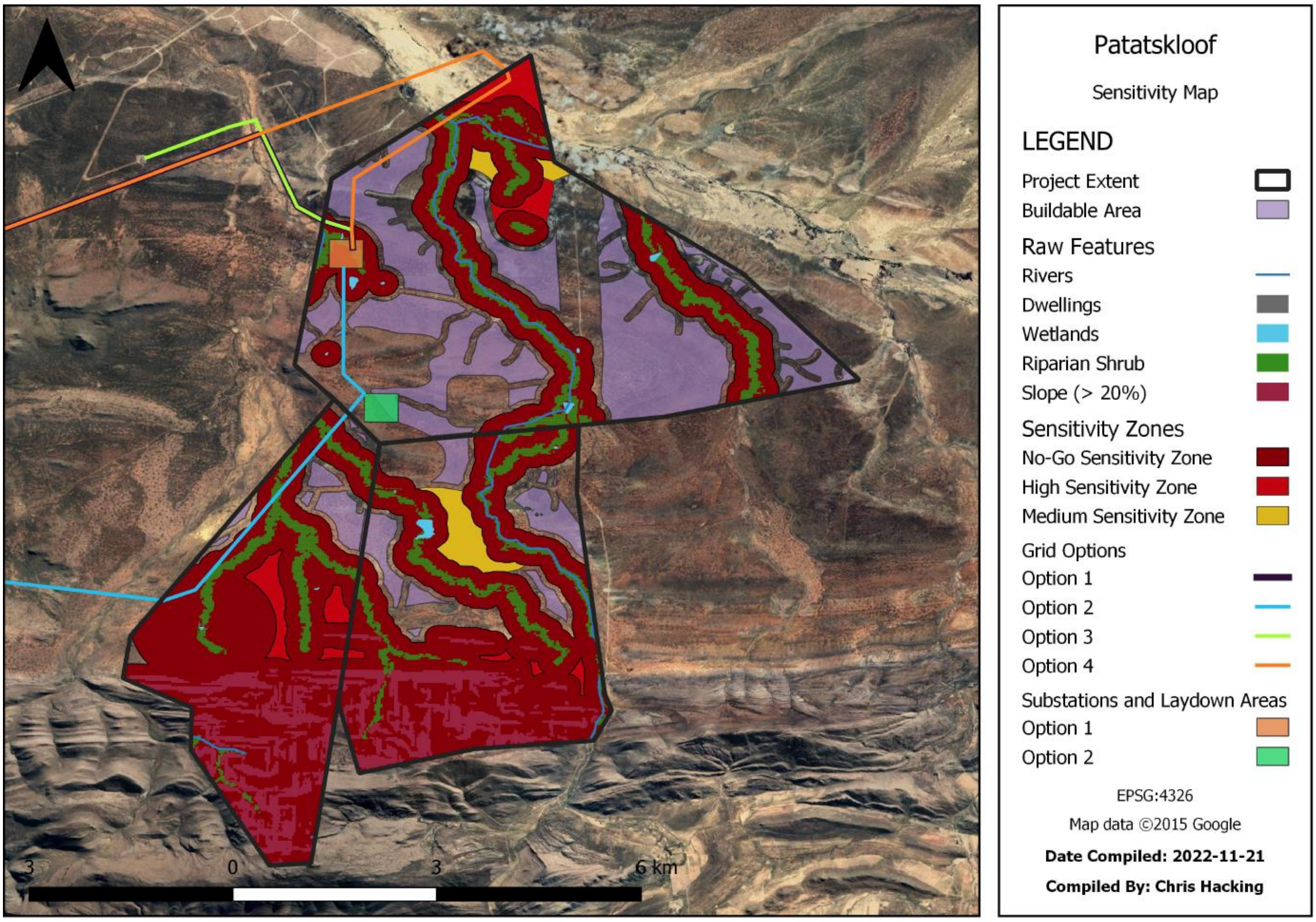



***Figure 35: Patatskloof WEF updated bat sensitivity map***

## 8. CUMULATIVE IMPACT

As South African legislation facilitates Independent Power Producers (IPP) and promotes renewable energy into the electricity generation mix, there has been a substantial increase in renewable energy developments recently, specifically WEFs. However, the trade-offs of cumulative impacts on the natural environment need to be understood by all involved parties to assess the benefits of renewable energy against the obligation for bat conservation imperatives. Cumulative impacts are activities that might not be noteworthy when considered on their own but may potentially become significant when added to "existing and potential impacts eventuating from similar or diverse activities or undertakings in the area." NEMA requires an integrated approach for environmental authorisation to develop wind energy (NEMA Regulations, 1998).

Bats species confirmed on site have functional roles in terms of agricultural pest control, insect predation, pollination, and seed dispersal. However, they are susceptible to anthropogenic changes due to their low reproductive rate and longevity. The cumulative impact of mismanagement of natural resources resulting from the construction and operational activities of WEFs could limit bat activity and lead to bat habitat destruction and eventual bat population decline. These impacts could lead to an elevation of insect numbers and potential insect outbreaks across project sites and the region. For instance, the ecology of bat caves (where guano is the primary energy source) can be adversely affected by negative impacts on migratory bats (Marais, 2018). Therefore, bat activity at proposed WEFs caused by wind turbines must be assessed to prevent or mitigate the cumulation negative impacts on bat populations (Sowler, et al., 2017).

The Department of Forestry, Fisheries and Environment, (DFFE) requires a regional combined impact assessment of bat fatalities on combined Renewable Energy Facilities (REFs) within a 35 km radius of the proposed site. The literature indicates that migratory and resident bats could cover wide distances, such as between 1 and 15 km (Jacobs & Barclay, 2009; MacEwan, 2018) and 2 to 30 km (NEMA Regulations, 2022). SABAA recommends that a larger area of up to 100 km radius from the proposed WEF be assessed bats to understand the ecological significance of bats in the greater area (MacEwan, et al., 2018).

The proposed Patatskloof WEF forms part of the approximately 8 846 km$^2$ Komsberg REDz 2, situated in the Western Cape, north-east of Touws River and further north-eastwards towards Sutherland. REDz are areas identified at a strategic level as having topography generating high wind speed variability. This allows energy producers to maximise the cumulative wind energy production and minimise the negative impacts (Van Vuuren & Vermeulen, 2019). Wind farms situated in these zones in South Africa are fast-tracked for approval and more wind energy applications are expected in these zones. The consequence of adding more wind farms will increase the cumulative effect on bats in the area if all developments are either operational or under construction at the same time.

Table 7 contains a summary of features specific to the proposed Patatskloof WEF and of bats confirmed on site. Figure 36 displays a view of the regional wind energy developments, featuring Patatskloof WEF surrounded by REFs within a 35 km radius interval. This allows for a consideration of the cumulative impact on bats, locally and regionally. Table 8 provides a summary of REFs within a 35km radius of Patatskloof WEF, informing the assessment of the nature of the cumulative effect on bats, as per the South African Good Practice Guidelines for Pre-Construction Monitoring of Bats (Sowler, et al., 2017) and the South African Bat Fatality Threshold Guidelines (MacEwan, et al., 2020).

**Table 7: A summary of site-specific information of Patatskloof WEF**

| | |
|---|---|
| REDz | Komsberg 2 |
| Project size | 6612 ha |
| Power Capacity | 250 MW |
| Municipality and Province | Cape Winelands Municipality in the Western Cape |
| Biome and Ecoregion | Succulent Karoo with limited Fynbos and Azonal Vegetation |
| Bat conducive features | Open water, rivers and gullies for drinking and as insect breeding, lights around guest house |
| Period of high bat activity | Spring and summer |
| Period of low bat activity | Bat activity decreases during low temperatures in colder months and high winds |
| Bat occurrence on site and in the region | 5 bat species recorded on-site out of 12 bat species that occur in the region |
| Bats at risk of direct impacts | *T. aegyptiaca, N. capensis, M. natalensis, E. hottentotus, S. petrophilus* |

On a regional scale, the Tooverberg, Perdekraal and Witberg WEFs within the 35 km radius of Patatskloof are already approved. Portions of approved Rietkloof, Brandvalley and Roggeberg WEFs also appear within 35 km of Patatskloof and are included in the cumulative calculations. Karee WEF, adjacent to Patatskloof WEF, is currently in the application process for approval. The proposed Karee WEF site appears on the map inFigure 36 and is also included in the cumulative calculations, but the proposed Kappa 1 and 2 do not appear as the applications have not been submitted yet. In compliance with SABAA recommendations to consider bats in the larger area, there are several more WEFs within the Komsberg Redz 2 and closer to Sutherland, such as Hidden Valley, Komsberg West, Roggeveld, Kareebosch, Marella, Kudusberg, Rondekop, Isiyago, Eolos, Gunstfontein and Sutherland.

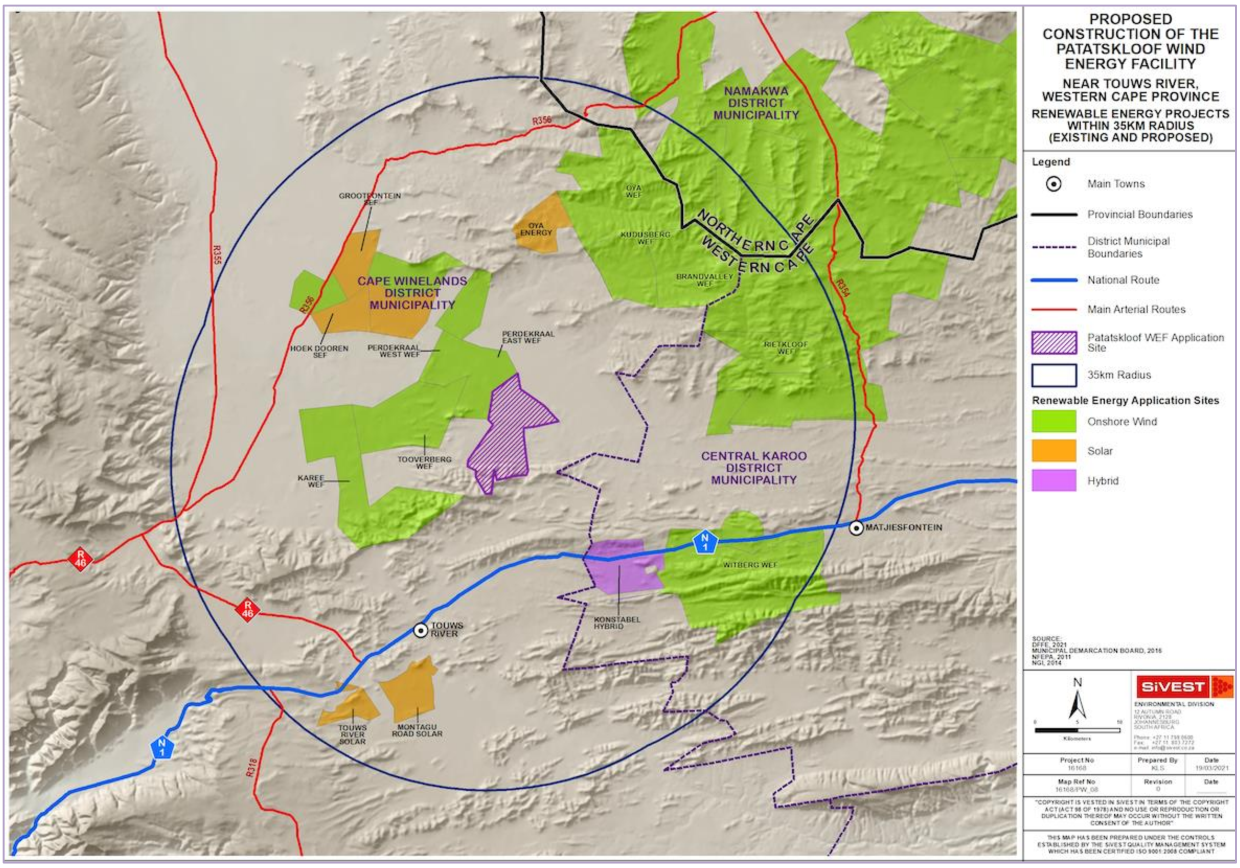



**Figure 36: Patatskloof WEF surrounding by other wind energy facilities within a 35 km circle**

WEFs within Komsberg REDz create clusters of wind turbine development and bats in the wider area would have to create corridors of movement to negotiate around these development zones. Due to the back-to-back nature of the wind farms, the cumulative sensitivity effect will be amplified across the area and impact the biodiversity and ecological processes related to bat habitat, bat activity, bat mortality and bat population will decline.

Other REFs, including Touwsrivier, Montague Road, Oya, Grootfontein and Hoek solar farms are also situated within the 35 km radius of the proposed Patatskloof WEF. The negative impact on bats from solar energy development is low. However, large areas of solar PVC panels destroy bats natural habitat. Solar projects cover approximately 1 500 ha of land within the 35 km radius of the proposed Patatskloof WEF.

### Table 8: A summary of REFs within a 35 km radius of Patatskloof WEF

| RISK LEVELS AS PER SABAA GUIDELINES (Sowler, et al., 2017 & MacEwan, et al., 2020) | | | | | | | |
|---|---|---|---|---|---|---|---|
| REFs within 35 km radius of Patatskloof WEF | Energy Ouput MW | Total Project Size (ha)* | Bat Index based on Average Bat passes per hour per year** | Bat Index based on Median Bat passes per hour per year** | Bat fatality risk levels based on Succulent Karoo at >40m rotor sweep height*** | Bat fatality risk levels based on Median bat activity | Threshold based on ecoregion and total project size (ha): How many bats can be removed before population decline may arise |
| Proposed Patatskloof WEF | 250 | 6612 | 1,92 | 0,37 | 0.08-0.21 | High | 55 |
| Proposed Karee WEF | 200 | 1753 | 1,65 | 0,43 | 0.08-0.21 | High | 15 |
| Proposed Kappa 1 Wind Farm | 190 | 3895 | 0,27 | 0,21 | 0.02-0.23 | High | 61 |
| Proposed Kappa 2 Wind Farm | 250 | 6612 | 1,92 | 0,62 | 0.02-0.23 | High | 31 |
| Perdekraal East WEF | 110 | 3055 | 0,37 | 0,00 | 0.02-0.23 | High | 26 |
| Perdekraal West WEF | 140 | 3220 | 0,36 | 0,00 | 0.02-0.23 | High | 27 |
| Tooverberg WEF | 264 | 750 | 0,25 | 0,00 | 0.02-0.23 | High | 6 |
| Brandvalley WEF | 140 | 9299 | 0,33 | 0,00 | 0.02-0.23 | High | 78 |
| Witberg WEF | 80 | 1260 | 0,04 | 0,00 | 0.02-0.23 | Low | 11 |
| Roggeveld WEF | 140 | 2652 | 0,33 | 0,00 | 0.02-0.23 | High | 22 |
| Rietkloof WEF | 183 | 1270 | 0,48 | 0,00 | 0.02-0.23 | High | 11 |
| Total for all WEFs | 1557 | 34730 | 0,72 | 0,40 | 0.02-0.23 | High | 342 |
| Total PVC Solar | 300 | 1500 | | | | | |
| Total for all REFs | 1857 | 36230 | 0,72 | 0,40 | 0.02-0.23 | High | 342 |

As more turbines are monitored, a linear increase in bat fatalities is reported. Cumulative impacts on bat fatalities are predicted and assessed at fatality risk levels based on proportional bat occupancy per hectare of each of South Africa's Terrestrial Ecoregions to calculate cumulative impact thresholds (MacEwan, et al., 2017 and 2020; Sowler, et al., 2017).

Occasional inconsistencies exist in the methodologies applied across sites such as uniform measurements of recording conditions and location of bat detectors as well as the size of the development project. These inconsistencies limit the exactness of calculating thresholds to gauge the extent of the cumulative impact. Due to these inconsistencies, amendments were made in Table 8 to inform the impacts as outlined below:

*Due to historical data measurements, significant variation often exists in the approximate project sizes documented from studies at adjacent and regional WEFs to the study area under investigation. In this case, project sizes range from 750 ha to 9 299 ha. The lack of uniformity impacts the exactness of bat fatality thresholds as some studies record a total project size and other studies mention a footprint of buildable and laydown area between 4 to 10% of the total project size. Despite thorough literature reviews of previous documents and attempts to find uniformity in project size measurement, the bat fatality thresholds in Table 8 are calculated on total project size albeit with significant variations in size.

**Bat activity calculations for studies of approved WEFs adjacent to Patatskloof WEF as well as regional WEFs are compliant with previous guidelines and differ from current guidelines. Therefore, Table 8 presents bat activity indices based on average and median calculations. Median calculations for the Patatskloof and Karee WEFs are based on 'near ground' and 'rotor sweep" recordings and the average of the recordings is presented in Table 8. For Patatskloof WEF the 'near ground' median is 0.83 and the 'turbine sweep' median is 0.40. The recorded average is 0.62. Although bat indexes based on average bat passes are not required by the current 2020 bat monitoring guidelines for Patatskloof WEF, they are recorded in Table 8. The bat indices (based on average bat passes per hour per year) for Patatskloof WEF and Karee WEF were calculated from recordings done in 2021 and 2022 and are much higher than the bat indices of surrounding WEFs recorded in previous years (between 2015-2019). In previous years of investigation in the region, severe drought prevailed which caused a reduction in bat activity. The region received widespread rain in 2021 and 2022 and bat activity increased. Bat activity can show a swift response to fluctuations in weather conditions in semi-dessert regions and bat specialists investigating regional WEFs with previous lower bat activity are currently monitoring higher bat activity than shown in Table 8.

***The bat fatality risk level calculation for ecoregional Succulent Karoo and Fynbos ranges from the low level (>0.02) for Succulent Karoo xeric Shrublands to the high level (>0.23) for Fynbos Shrubland at rotor sweep. The range used in Table 8 overlaps to cover the low and high ranges for both ecoregions and the bat fatality risk levels are rated and recorded accordingly (MacEwan, et., 2020).

Furthermore, based on the data available from some of the previously recorded studies it is recommended that bat activity levels are recorded and reported above 40 m height for bat fatality risk rating instead of below 11 m and above 50 m. Some of these previous studies indicated that between 1.8 and 6.5 fewer bats were recorded at 60 m than at 40 m height (Marais, 2015). Bat activity recorded at above 40 m could potentially be an accurate result for bat activity at rotor sweep.

****Threshold calculations used in this report do not involve the number of turbines or MW. They are based on the number of bats in addition to natural population losses, which can be removed from the area before population declines arise. These threshold calculations can be applied to any development that may result in bat fatalities (MacEwan, et al., 2020).

Based on natural population dynamics and bat occupancy per ecoregion, the threshold calculations for Patatskloof WEF for insectivorous bats should not exceed 46 bats per annum per family or species. This is based on bat fatality thresholds per ecoregion for Fynbos Shrubland and Succulent Karoo xeric Shrublands. Values are adjusted for biases such as searcher inefficiency, carcass persistence as well as fatalities of bats targeted for conservation purposes. When 47 or more bat fatalities occur, mitigation should be applied. Threshold calculations for cumulative impacts on bat populations at the proposed Patatskloof WEF and the surrounding WEFs within a 35 km radius within Komsberg REDZ should not exceed 240 bats per annum. This calculation is based on bat fatality thresholds per ecoregion for Fynbos Shrubland and Succulent Karoo Xeric Shrublands using the SABAA Cumulative Threshold calculations (MacEwan, et al., 2020). A very small part of Patatskloof WEF consists of Azonal Tankwa Wash Riviere vegetation that is included as Succulent Karoo in the threshold calculation.

Mitigation measures are implemented where site-specific (47 bats per annum) and regional thresholds (240 bats per annum) are exceeded. If bat fatalities for a total area exceed the threshold, collective mitigation and other conservation efforts should be applied. The developer/operator is responsible for the specific site and the collective of government, developers and operators for the region are responsible for complying with the implementation of mitigation measures to reduce the impact of negative cumulative impacts (MacEwan, et al., 2020).

Mitigation measures are recommended based on impact ratings to help reduce the possibility of population-level declines and should be implemented if annual adjusted fatalities per hectare exceed the thresholds. The requirement for mitigation is triggered when the overall annual threshold per species or family group of bats is exceeded. Thereafter, the type, intensity, turbine identification and periods of mitigation are refined based on actual fatality data per turbine.

Unless mitigation is implemented, there is a risk of infringing the NEMA: Biodiversity Act 10 of 2004. It remains the responsibility of each WEF developer/operator to apply mitigation to lower individual risk levels and keep the estimated impacts below acceptable sustainability thresholds. Applying thresholds and adhering to effective mitigation measures in practice will reduce residual impacts and lower the overall cumulative impact of all WEFs in the area. The most effective method of mitigation after turbine placement (where all parts of the turbine infrastructure are kept out of high bat-sensitive areas to reduce fatal impacts) is the alteration of blade speeds and ensuring cutting in speed in environmental conditions favourable to bats (Sowler, et al., 2020, MacEwan, et al., 2018 and Marais, 2018).

# 9. PROPOSED MITIGATION MEASURES

## 9.1 Turbine positions

The first step in mitigating the potential negative impacts of a proposed WEF on bats is to site turbines outside of sensitive areas. The sensitive mountain areas in the southern parts of the project site have already been avoided during the planning of the area for development. Figure 7 on page 19, furthermore indicates the sensitivity zones within the development area and it is recommended that the applicant shift the turbine positions out of the ‘no-go’ and high sensitivity areas. The updated sensitivity map, Figure 35, indicated no turbine positions yet, it is therefore recommended that turbines are not placed in No-go and high sensitivity areas, while turbines in medium sensitivity areas are mitigated as indicated in Section 9.3.

## 9.2 Feathering of all turbines below cut-in speed

Normally, operating turbine blades are at right angles to the wind. To avoid bat fatality when turbines are not generating power, feathering as a mitigation measure is applied where the angle of the blade is pitched parallel with the wind direction so that the blades only spin at very low rotation and that there is no risk to bats. The turbines will not come to a complete standstill, but the movement of the turbines would be minimal.

The cut-in speed is the lowest wind speed at which turbines generate power. Freewheeling occurs when turbine blades are allowed to rotate below the cut-in speed which increases the risk of collision in areas already sensitive to bat activity. As bats are more active at low wind speeds, mortality during freewheeling should be prevented as much as possible, and to an extent that bat mortality is avoided below cut-in speed. It is recommended that this mitigation measure commences immediately after the installation of turbines, after the necessary tests on turbines have been concluded, but before the commercial operation date, and is followed for the duration of the project. Turbine blades are usually feathered around 90 degrees to prevent freewheeling, but the angle will depend on the turbine make and model.

## 9.3 Recommended curtailment for turbines in the medium sensitivity zones

Currently, the most reliable and effective mitigation is curtailment (Arnett and May, 2016; Hayes, 2019). Curtailment entails locking or feathering the turbine blades during high bat activity periods to reduce the risk of bat mortality via collision with blades and barotrauma. This results in a reduction of the power generation during conditions when electricity would usually be supplied.

Curtailment regimes are developed by examining the relationship between relative bat activity levels and weather conditions. Bat activity is typically reduced at higher wind speeds, lower temperatures, and a site-specific range of humidity. Unfortunately, personal experience and unpublished data in South Africa indicate that *Molossidae* bats in Southern Africa fly at higher wind speeds than originally predicted. Nevertheless, lower wind speeds and warmer temperatures typically correlate with higher bat activity levels, as seen in Section 6, and bat mortality could be reduced by using weather conditions to predict bat activity.

This relationship between bats and weather conditions as well as seasonal activity are used to inform curtailment schedules that should be applied when bat activity is high, to reduce potential encounters of bats with wind turbine blades. These relations are presented in Section 6 of this report and were used to compile the below curtailment schedule.

At present, curtailment is only recommended for turbines situated in the medium sensitivity zone. Close observation during the bat monitoring to be conducted during the post-construction phase, should inform, and refine the curtailment schedule, and apply it to more turbines, as necessary. If curtailed turbines show consistent low activity through static recordings as well as mortality in the low threshold range, the bat specialist could adapt curtailment again.

It is recommended that curtailment is applied during the specified time periods when the relevant temperatures, wind speeds and humidity prevail. See Table 9 for the turbines situated in the medium sensitivity zone. Fatality risk at the high mast indicates curtailment is required from September to March.

**Table 9: Curtailment schedule for turbines situated in medium sensitivity zone.**

| MITIGATION FOR TURBINES SITUATED IN MEDIUM SENSITIVITY ZONES | | | | | |
|---|---|---|---|---|---|
| *Months* | *Time period* | *Temperature (°C)* | *Wind speed (m/s)* | *Humidity (%)* | *Curtailment* |
| Beginning October to middle March | 2 hours after sunset, up to 7 hours before sunrise | Above 15ºC | Below 10 m/s | Between 40% and 70% humidity | Raise cut-in speed to 7 m/s |

## 9.4 Bat deterrents

Bat deterrent suppliers indicate that *Molossidae* bats react well to deterrents. This could be an option for mitigation but will have to be discussed with a bat specialist and the applicant. It is believed that the new supplier of bat deterrents in South Africa will be able to not only drive the research in deterrents and South African bat species, but also make deterrents more readily available to developers.

## 9.5 Avoid creating bat conducive areas

The aim of mitigation recommendations is to protect the current bat population, and to avoid creating any features that might attract bats to the development site. It is therefore recommended that:

- The roofs of all new buildings are sealed, keeping in mind that a small bat could enter a hole of one square centimetre. If no bats are residing in the current building on the project site, the developer could discuss the situation with the land owner and propose to also seal the corrugated roof of this building to avoid any bat roosts in future.
- Any new quarries or burrow pits which could collect standing water are rehabilitated.

No roosts were found during the 12-month bat monitoring study, but if any roost are found during the construction or operational phase, a bat specialist should be consulted immediately.

If deemed necessary during the operational phase, the developer could discuss the option of sealing the roofs of current buildings. These buildings are all situated in ‘no-go’ and high sensitivity areas, and although many bats have been observed at Ibhadi guest house, no roosts could be detected in the roofs of the buildings.

## 9.6 Operational bat monitoring

Operational bat monitoring should be conducted for at least two years, as per the latest SABAA operational bat guidelines of the time, and longer if deemed necessary by the operational bat specialist. Bat monitoring, including carcass searches, will have to start at the turn of the turbine blades, after testing of turbines have been completed, as the highest mortality is often experienced in the first year of a WEF. It is therefore important that the bat specialist is appointed before Commercial Operational Date (COD).

# 10. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BAT IMPACT

## 10.1 Components of the project which could impact bats

Components of the proposed Patatskloof WEF which could negatively impact bats, directly through mortality during the operational phase, and indirectly, through the loss of foraging habitat, are the following:

- The noise of construction activities.
- Clearance of natural vegetation for electrical connections, upgrading of access roads, creating hard standing areas or laydown areas.
- Demolition of existing buildings.
- New buildings, such as the substation and BESS complex.
- Excavating areas or creating borrow pits (if required).
- Operational wind turbines.
- Artificial lighting.
- Decommissioning activities.

## 10.2 Potential Impact on Bats

Bats are long-lived mammals and females often produce only one pup per year, resulting in a life strategy characterized by slow reproduction (Barclay and Harder, 2003). Because of this, bat populations are sensitive to changes in mortality rates and their populations tend to recover slowly from declines.

The potential impact on bats includes the following:

**Construction phase:**

- <u>Loss of existing roosts and/or potential roosts</u>: Some of the bat species that occur on the proposed site are known to roost in the rock formations, crevices, derelict aardvark holes and under the bark of trees (see Table 2). Any disturbance of these natural roosting opportunities might have a negative impact on bats. Demolition of the few existing buildings will destroy bat roosts in those buildings.
- <u>Attracting bats by artificially creating new roosting areas</u>: The presence of new buildings within the study area may provide additional roost sites for those species making use of man-made structures.

**Operational phase:**

- Direct collisions with rotating turbine blades: The most important aspect of the project that affects bats adversely are the wind turbines, and in particular, direct collisions from the operational rotating blades.
- Fatalities from barotrauma: As the air moves over the turning turbine blades, an area of low pressure is created. Barotrauma occurs when bats experience a sharp decrease in atmospheric pressure near rotating turbine blades. This pressure drop causes a rapid expansion of the lungs, which is unable to be remedied through proper exhalation (Baerwald et al., 2008), thus resulting in the haemorrhage of the lungs and ultimately mortality.
- Loss of foraging habitat: The turbines, during operation, will influence the natural foraging space of bats. Disturbance resulting from construction activities, such as noise after sunset from engines or generators, might also deter bats, resulting in loss of feeding habitat.

Throughout the lifespan of the project, the ideal bat situation is to maintain bat populations as they occur on-site, and to avoid attracting more bats to the area of a potential collision.

## 10.3 Construction

**Table 10: Rating of impacts that could potentially occur during the construction phase.**

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+/ -) | S | E | P | R | L | D | I/M | Total | Status (+/ -) | S |
| **CONSTRUCTION PHASE** | | | | | | | | | | | | | | | | | | | |
| Clearing and excavation of natural habitat | The destruction of features that could serve as potential roosts, such as rock formations and the removal of trees on the project site. The destruction of derelict holes, such as aardvark holes, and any fragmentation of woody habitat which include relative dense bushes. The removal of limited trees and bushes would have an impact on all bats that could potentially roost in and or the foraging habitat of clutter and clutter-edge species. | 1 | 4 | 3 | 3 | 4 | 3 | 42 | - | Medium | 1 | 4 | 2 | 2 | 2 | 2 | 22 | - | Low |

**MITIGATION MEASURES:**

- Apart from access roads, construction activities to be kept out of all no-go and high bat sensitive areas.
- Rock formations occurring along the ridge lines should be avoided during construction, as these serve as roosting space for bats.
- Destruction of trees should be avoided during construction.
- Care should be taken that now roosts occur in the vegetation if any dense bushes are destroyed.
- Aardvark holes or any large derelict holes or excavations should not be destroyed before careful examination for bats. The Environmental Control Officer (ECO), or a responsible appointed person or site manager, should contact a bat specialist before construction commences so that they know what to look out for during construction.

<table>
<tr><th rowspan="2">Environmental Parameter</th><th rowspan="2">Issue / Impact / Environmental Effect/ Nature</th><th colspan="9">Environmental Significance Before Mitigation</th><th colspan="9">Environmental Significance After Mitigation</th></tr>
<tr><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+/ -)</th><th>S</th><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+/ -)</th><th>S</th></tr>
<tr><td colspan="20">CONSTRUCTION PHASE</td></tr>
<tr><td>Excavation and building new structures</td><td>Creating new habitat amongst the turbines which might attract bats. This includes buildings with roofs that could serve as roosting space or open water sources from quarries or excavation where water could accumulate.</td><td>1</td><td>4</td><td>2</td><td>2</td><td>3</td><td>2</td><td>24</td><td>-</td><td>Low</td><td>1</td><td>4</td><td>1</td><td>1</td><td>2</td><td>2</td><td>18</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:<br>▪ Completely seal off roofs of new buildings (e.g., substations and site buildings). Note, a small bat species could enter a hole the size of 1 $cm^2$.<br>▪ Roofs need to be regularly inspected during the lifetime of the WEF, and if no bats have moved into roofs, any new holes need to be sealed.<br>▪ Excavation areas, quarries or any other artificial depressions should be filled and rehabilitated to avoid creating new areas of open water sources which could attract bats during rainy spells.</td></tr>
<tr><td>Noise and light disturbance</td><td>Construction noise, especially during night-time, as well as lighting disturbance.</td><td>1</td><td>3</td><td>2</td><td>3</td><td>2</td><td>2</td><td>22</td><td>-</td><td>Low</td><td>1</td><td>3</td><td>1</td><td>1</td><td>1</td><td>1</td><td>7</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:<br>▪ Nightly construction activities should be avoided, or if necessary, minimised to the shortest period possible.<br>▪ With the exception of compulsory civil aviation lighting, artificial lighting during construction should be minimised, especially bright lights or spotlights.<br>▪ Lights should avoid skyward illumination. Turbine tower lights should be switched off when not in operation, where possible.</td></tr>
</table>

## 10.4 Operation

Although there is a high negative impact after mitigation for direct collision or barotrauma, this is not a fatal flaw if the developer adheres to the recommended sensitivity map (Section 7) and the recommended mitigation measures (Section 9).

**Table 11: Rating of impacts that could potentially occur during the operational phase.**

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| Direct collision or barotrauma | Fatality through direct collision or barotrauma of resident bats occupying the airspace amongst the turbines. The turning blades of the turbines during operation are the most important aspect of the project that would impact negatively on bats. High flying species have predominantly been confirmed at the proposed Patatskloof WEF site. | 3 | 4 | 3 | 4 | 3 | 3 | 51 | - | High | 2 | 4 | 3 | 3 | 3 | 3 | 45 | - | High |

**MITIGATION MEASURES:**

- All turbines and turbine components, including the rotor swept zone, should be kept out of all no-go and high sensitivity zones.
- Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.
- Mitigation, as proposed for medium sensitivity zones proposed in Section 9, Table 8, should be applied after testing, as soon as turbines start to turn.
- A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn.

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| ▪ At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et. al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant South African guidelines as applicable during the monitoring period.<br>▪ Mitigation should be discussed between the bat specialist and developer during the operational phase. Mitigation should be adapted and implemented without delay. Where high bat mortality occurs, turbine-specific mitigation measures should be applied, using Section 9 as a starting point for discussions.<br>▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.<br>▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines, but having more refined static data from sampling points at height, would aid in interpreting future bat fatality records of the Patatskloof WEF. | | | | | | | | | | | | | | | | | | | |
| Bat migrations | Bat fatality during migration. A limited number of calls like *Miniopterus natalensis* (Natal Long-fingered bat), a Near Threatened migration species, have been recorded. Not much research has been conducted on migration of bats in South Africa, and some of the other species occurring on the project site could also migrate. | 3 | 2 | 3 | 3 | 3 | 2 | 28 | - | Medium | 2 | 2 | 2 | 2 | 3 | 2 | 22 | - | Low |
| **MITIGATION MEASURES:**<br>▪ Care should be taken during post construction monitoring to verify the activity of *M. natalensis*, especially within the rotor swept area of the turbine blades.<br>▪ Carcasses should be identified timeously so as to establish the fatality of this species, or any other migrating bat species. | | | | | | | | | | | | | | | | | | | |

<table>
<tr><th rowspan="2">Environmental Parameter</th><th rowspan="2">Issue / Impact / Environmental Effect/ Nature</th><th colspan="9">Environmental Significance Before Mitigation</th><th colspan="9">Environmental Significance After Mitigation</th></tr>
<tr><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+ /-)</th><th>S</th><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+/-)</th><th>S</th></tr>
<tr><td colspan="20">OPERATIONAL PHASE</td></tr>
<tr><td colspan="20">
<ul>
<li>All turbines and turbine components, including the rotor swept zone, should be kept out of all no-go and high sensitivity zones.</li>
<li>Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.</li>
<li>Mitigation, as proposed for medium sensitivity zones proposed in Section 9, Table 8, should be applied after testing, as soon as turbines start to turn.</li>
<li>A bat specialist should be appointed before the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn.</li>
<li>At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et. al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant South African guidelines as applicable during the monitoring period.</li>
<li>Mitigation should be discussed between the bat specialist and developer during the operational phase. Mitigation should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.</li>
<li>Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.</li>
<li>It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines, but having more refined static data from sampling points at height, would aid in interpreting future bat fatality records of the Patatskloof WEF. Therefore, the installation of more than one monitoring system at height, is important.</li>
</ul>
</td></tr>
<tr><td>Loss of bats of conservation value</td><td>Some calls like the red data Miniopterus natalensis have been recorded, as well as the endemic Eptesicus hottentotus.</td><td>2</td><td>3</td><td>2</td><td>3</td><td>3</td><td>2</td><td>30</td><td>-</td><td>Medium</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>2</td><td>18</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:
<ul>
<li>Loss of bats of conservation value. A limited number of calls like the Near Threatened M. natalensis have been recorded, as well as the endemic E. hottentotus. Proven mitigation measures, such as curtailment, should be timeously applied if high activity of bats of conservation value is recorded, or if high numbers of carcasses are collected, during post-construction.</li>
</ul>
</td></tr>
</table>

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| ▪ Carcasses should be identified, even if it is a preliminary identification, timeously, to establish if there are any red data species.<br>▪ All turbines and turbine components, including the rotor swept zone, should be kept out of all no-go and high sensitivity zones.<br>▪ Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.<br>▪ Mitigation, as proposed for medium sensitivity zones proposed in Section 9, Table 8, should be applied after testing, as soon as turbines start to turn.<br>▪ A bat specialist should be appointed **before** the turbines start to turn and operational bat monitoring should start when all the turbines start to turn.<br>▪ At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et. al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant South African guidelines as applicable during the monitoring period.<br>▪ Mitigation should be discussed between the bat specialist and developer during the operational phase. Mitigation should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.<br>▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.<br>▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines, but having more refined static data from sampling points at height, would aid in interpreting future bat fatality records of the Patatskloof WEF. Therefore, the installation of more than one monitoring system at height, is important. The adjacent Perdekraal East data from the nearby met mast might assist with this, if the developer would be allowed to use this data. | | | | | | | | | | | | | | | | | | | |
| Fatal curiosity | Bat mortality due to the attraction of bats to wind turbines. Bats have been shown to sometimes be attracted to wind turbines out of curiosity or reasons still under investigation. | 1 | 3 | 2 | 2 | 3 | 2 | 26 | - | Medium | 1 | 2 | 2 | 3 | 2 | 2 | 20 | - | Low |

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| **MITIGATION MEASURES:**<br>▪ Bat mortality due to the attraction of bats to wind turbines (Horn, et al., 2008). Bats have been shown to sometimes be attracted to wind turbines out of curiosity or reasons still under investigation.<br>▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.<br>▪ Little is known about this impact, and mitigation should be adapted if more research becomes available. | | | | | | | | | | | | | | | | | | | |
| Foraging space lost due to the turning of turbine blades | Loss of habitat and foraging space during operation of the wind turbines. | 2 | 4 | 2 | 3 | 3 | 3 | 42 | - | Medium | 2 | 4 | 2 | 3 | 3 | 2 | 28 | - | Medium |
| **MITIGATION MEASURES:**<br>▪ All turbines and turbine components, including the rotor swept zone, should be kept out of all no-go and high sensitivity zones.<br>▪ Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.<br>▪ Mitigation, as proposed for medium sensitivity zones proposed in Section 9, Table 8, should be applied after testing, as soon as turbines start to turn.<br>▪ A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or described by the latest South African bat guidelines.<br>▪ At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et. al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant South African guidelines as applicable during the monitoring period.<br>▪ Mitigation should be discussed between the bat specialist and developer during the operational phase. Mitigation should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions. | | | | | | | | | | | | | | | | | | | |

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| ▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.<br>▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines, but having more refined static data from sampling points at height, would aid in interpreting future bat fatality records of the Patatskloof WEF. Therefore, the installation of more than one monitoring system at height, is important. The adjacent Perdekraal East data from the nearby met mast could aid with this, if the developer would be allowed to use this data. | | | | | | | | | | | | | | | | | | | |
| Smaller genetic pool | Reduction in the size, genetic diversity, resilience, and persistence of bat populations. Bats have low reproductive rates and populations are susceptible to reduction by fatalities other than natural death. Furthermore, smaller bat populations are more susceptible to genetic inbreeding. | 3 | 4 | 3 | 3 | 3 | 3 | 51 | - | High | 3 | 3 | 2 | 3 | 3 | 3 | 42 | - | Medium |
| **MITIGATION MEASURES:**<br>▪ Proven mitigation measures, such as curtailment, should be applied if high activity of bats of conservation value is recorded, or if high numbers of carcasses are collected, during post-construction.<br>▪ All turbines and turbine components, including the rotor swept zone, should be kept out of all no-go and high sensitivity zones.<br>▪ Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.<br>▪ Mitigation, as proposed for medium sensitivity zones proposed in Section 9, Table 8, should be applied after testing, as soon as turbines start to turn.<br>▪ A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn. | | | | | | | | | | | | | | | | | | | |

| Environmental Parameter | Issue / Impact / Environmental Effect/ Nature | Environmental Significance Before Mitigation | | | | | | | | | Environmental Significance After Mitigation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+ /-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **OPERATIONAL PHASE** | | | | | | | | | | | | | | | | | | | |
| ▪ At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et. al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant South African guidelines as applicable during the monitoring period.<br>▪ Mitigation should be discussed between the bat specialist and developer during the operational phase. Mitigation should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.<br>▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.<br>▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines, but having more refined static data from sampling points at height, would aid in interpreting future bat fatality records of the Patatskloof WEF. Therefore, the installation of more than one monitoring system at height, is important. The data from the adjacent met mast at Perdekraal could assist with this, if the developer would be allowed to use this data. | | | | | | | | | | | | | | | | | | | |

## 10.5 Decommissioning

**Table 12: Rating of impacts that could potentially occur during the decommissioning phase.**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+/ -) | S | E | P | R | L | D | I/M | Total | Status (+ /-) | S |
| **DECOMISSIONING PHASE** | | | | | | | | | | | | | | | | | | | |
| Removal of turbines | Bat disturbance due to decommissioning activities and associated noise, especially during night-time. | 1 | 4 | 1 | 2 | 1 | 2 | 17 | - | Low | 1 | 3 | 1 | 1 | 1 | 1 | 7 | - | Low |

**MITIGATION MEASURES:**

- Except for compulsory lighting required in terms of civil aviation, artificial lighting during construction should be minimised, especially bright lights or spotlights.
- Lights should avoid skyward illumination.
- Night-time decommissioning activities should be avoided as far as possible.

## 10.6 'No-go' Impact

Should the proposed WEF development not go ahead, none of the identified potential impacts would occur and the status quo would be maintained.

## 10.7 Cumulative Impacts

See Section 6 for a discussion of the cumulative effect. The significance of the identified cumulative impacts are rated in **Table 13** below. Although there are several high negative impacts after mitigation, this is not a fatal flaw. Cumulative impacts will most likely be high for all consecutive wind farms to follow.

**Table 13: Rating of cumulative impacts**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+/-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **CUMULATIVE IMPACTS** | | | | | | | | | | | | | | | | | | | |
| Destruction of active roosts on several WEFs. | Cumulative effect of destruction of active roost of several WEFs as well as features that could serve as potential roosts. | 3 | 4 | 3 | 3 | 3 | 3 | 48 | - | High | 3 | 2 | 2 | 2 | 2 | 2 | 22 | - | Low |
| **MITIGATION MEASURES:**<br>▪ Although the developer does not have any control over other wind energy development, project specific mitigation, as included in the BA or in the respective Bat Impact Assessments of the projects in the surrounding area, should be adhered to for each renewable energy project. This can however only be enforced by the regulating authority.<br>▪ Post construction monitoring as per the relevant South African guidelines. | | | | | | | | | | | | | | | | | | | |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+/-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| Direct collision and barotrauma of several WEFs. | Cumulative bat mortality due to direct collision with the blades or barotrauma during foraging of resident bats at several WEF sites. | 3 | 4 | 4 | 3 | 4 | 4 | 88 | - | High | 3 | 4 | 4 | 3 | 3 | 3 | 51 | - | High |
| **MITIGATION MEASURES:**<br>▪ Although not enforceable by the Patatskloof applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project.<br>▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance. | | | | | | | | | | | | | | | | | | | |
| Mortality of several WEFs on migrating bats. | Cumulative bat mortality of migrating bats due to direct blade impact or barotrauma during foraging of migrating bats on several WEFs | 3 | 3 | 3 | 3 | 3 | 3 | 45 | - | High | 3 | 3 | 2 | 3 | 3 | 3 | 42 | - | Medium |
| **MITIGATION MEASURES:**<br>▪ Although not enforceable by the Patatskloof applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project.<br>▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance. | | | | | | | | | | | | | | | | | | | |
| Several WEFs stretching over thousands of hectares. | Habitat loss over several WEFs | 3 | 4 | 3 | 3 | 3 | 4 | 64 | - | High | 3 | 4 | 3 | 3 | 3 | 3 | 48 | - | High |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I/M | Total | Status (+/-) | S | E | P | R | L | D | I/M | Total | Status (+/-) | S |
| **MITIGATION MEASURES:**<br>▪ Although not enforceable by the Patatskloof applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project.<br>▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance. | | | | | | | | | | | | | | | | | | | |
| Several WEFs with the associated bat mortality over the lifespan of WEFs. | Cumulative reduction in the size, genetic diversity, resilience, and persistence of bat populations | 3 | 4 | 3 | 3 | 4 | 4 | 68 | - | High | 3 | 4 | 3 | 3 | 3 | 3 | 54 | - | High |
| **MITIGATION MEASURES:**<br>▪ Although not enforceable by the Patatskloof applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project.<br>▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance. | | | | | | | | | | | | | | | | | | | |

## 10.8 Overall Impact Rating

Although the combined impact during the operational phase, after mitigation, is predicted to be Medium Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Succulent Karoo, is high and the negative impact on bats during the operational phase could thus be high. This must however be confirmed during operational bat monitoring.

Despite the negative high impact, there are no fatal flaws from a bat perspective and if the client adheres to mitigation measures, the impact on bats from the proposed Patatskloof WEF project site is predicted to be **Negative Medium,** with a combined significance rating of 36 before mitigation and 24 after mitigation (see Table 14).

**Table 14: Summary table of expected impacts associated with Patatskloof WEF**

| **Summary of impacts on bats by the Patatskloof WEF according to the SiVEST impact significance rating** | | |
|---|---|---|
| *Phase* | *Impact before mitigation (negative)* | *Impact after mitigation (negative)* |
| Construction | 29 (5-23) Medium | 16 (5-23) Low |
| Operation | 38 (24-42) Medium | 29 (24-42) Medium |
| Decommissioning | 16 (5-23) Low | 7 (5-23) Low |
| Cumulative | 63 (62-80) Very High | 43 (43-61) High |
| Combined for the site | 36 (24-42) Medium | 24 (24-42) Medium |

# 11. COMPARATIVE ASSESSMENT OF ALTERNATIVES

## 11.1 'No-Go' Alternative

The landowners indicated that should the WEF development not take place, the same land-use activities would prevail; thus, the status quo would be maintained. No negative impact is expected on bats should the WEF development not take place.

## 11.2 Layout Alternatives

No layout alternatives for the proposed Patatskloof WEF have been proposed or assessed as the position of the wind turbines and overall layout of the WEF have been informed by the identified sensitive and/or 'no-go' areas and their relevant buffers (where required). However, two site alternatives for the substation and two construction laydown area alternatives were proposed and have been comparatively assessed. Table 15 below provides the results of the comparative assessment of the substation site and construction laydown area alternatives from a bat perspective.

**Table 15: Comparative assessment of substation and laydown areas**

| Alternative | Preference | Reasons (incl. potential issues) |
|---|---|---|
| SUBSTATION SITE ALTERNATIVES | | |
| Substation Option 1 | Least preferred | • The area is situated in a riverbed with potential Karoo riverine vegetation.<br>• Clutter and clutter-edge foragers will be negatively impacted.<br>• The possibility of roost destruction is higher than at Option 2. |
| Substation Option 2 | Favourable | The area is situated outside the 'no-go' and high sensitivity zones |
| CONSTRUCTION LAYDOWN AREA SITE ALTERNATIVES | | |
| Construction Laydown Area Option 1 | Least preferred | A small percentage of the area overlays with the 'no-go' sensitivity zones. |
| Construction Laydown Area Option 2 | Favourable | • The area is situated in a riverbed with potential Karoo riverine vegetation.<br>• Clutter and clutter-edge foragers will be negatively impacted.<br>• The possibility of roost destruction is higher than at Option 2. |

Based on the results of the comparative assessment of alternatives, Substation Option 2 and Construction Laydown Area Option 2 are the preferred project alternatives.

Although Substation Option 2 and Construction Laydown Area Option 2 are the most preferable alternatives from a bat perspective, the impact of the position of the substation and laydown areas is not expected to be high and therefore there are no fatal flaws associated with either of the alternatives.

## 12. CONCLUSION AND SUMMARY

Calls like five of the 12 species that have distribution maps overlaying the proposed development site were recorded by the static recorders. 81% of the bat activity recorded at the Patatskloof WEF was by *Tadarida aegyptiaca* (Egyptian free-tailed bat) which is a high-risk species, physiologically adapted to fly at high altitudes within the vicinity of the turbine blades. Due to this foraging preference, the risk of collision and barotrauma is high. Two more species, *Sauromys petrophilus* (Roberts' flat-headed bat) (10%) and *Neoromicia Capensis* (Cape serotine bat) (8%) also showed a significant presence, while 1% of the activity was for the Near Threatened species *Miniopterus natalensis* (Natal long-fingered bat) and a statistically insignificant number of the endemic species *Eptesicus hottentotus* (Long-tailed house bat). At the proposed Patatskloof WEF, the Molossidae family (namely Free-tailed bats) is more dominant at the high-altitude systems, with *S. petrophilus* and *T. aegyptiaca* comprising 91% of all the activity recorded at height (Systems A and B).

An increase in bat activity was recorded in spring (September), when warmer temperatures were experienced, with a peak in October and a second, higher peak during late summer (February). Activity declined in early autumn (March). The second most abundant species, *S. petrophilus,* mimics the activity pattern of *T. aegyptiaca,* although the activity is substantially lower than the latter. The low activity lasts up to the middle of August. In general, bat activity in the Karoo tends to increase during warmer seasons, and according to the present data, this is also the case at Patatskloof WEF.

System C, situated at a height of 12 m on the Meteorological (i.e., Met) mast in the central to the south-western part of the terrain, recorded the highest bat activity. High activity was also recorded at the other two near-ground systems, G and H. Within the sweep of the turbine blades, System B at a height of 55 m, recorded higher activity in comparison to System A at a height of 105 m. One would therefore suspect that the highest mortality may be experienced in the lower region of the turbine sweep.

In general, all the monitoring systems show a sharp increase in activity approximately two to three hours after sunset. Although there are differences in the peak hours of the various systems, all the systems follow the same trend, with an increase in activity after sunset, peak activity between approximately 21:00 and 0:00, followed by a gradual decline in activity up to two to three hours before sunrise.

According to the South African Bat Threshold Guidelines (MacEwan *et al*., 2018), bat activity at near ground level, as well as within the rotor sweep area, falls in the highest risk category, with a combined hourly bat activity median of 0,83 near-ground and 0,40 in the rotor sweep. This is not regarded as a fatal flaw, but rather a confirmation of the recommended fatality minimisation measures for implementation during the operational phase (section 9 of the main report).

Data from the high systems A and B on the Met mast were statistically analysed for correlations between weather conditions and bat activity. Optimal conditions for bat activity on the terrain include temperatures above 15 ℃, wind speeds below 10 m/s and humidity levels between 40% and 70%.

Transect surveys showed a high number of 80 bat passes during the springtime (November), and 64 bat passes during an extra section driven in the southern section of the site, indicating that there are some nights, with optimal weather conditions and possible high insect occurrence, when bat activity is high. A transect conducted at the beginning of September, when the weather was still cold, recorded only one bat, confirming the low activity portrayed by the stationary systems during colder weather conditions.

A bat sensitivity map classified no-go, high and medium sensitivity zones (see below). It is recommended that no operating turbine components are allowed in the no-go and high sensitivity areas, whereas medium sensitivity zones could be developed with mitigation. Supporting infrastructures, such as the laydown area, site substation and Battery Energy Storage System (BESS) may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any possible bat roosts, as per the Environmental Management Programme (EMPr).

It is recommended that curtailment is applied in medium sensitivity zones during the time periods when a specific combination of temperature, wind speed and humidity prevail. Mitigation for specific turbines will need to be refined during the operational phase, using the below table as a starting point for such discussions:

| **MITIGATION FOR TURBINES SITUATED IN MEDIUM SENSITIVITY ZONES** | | | | | |
|---|---|---|---|---|---|
| *Months* | *Time period* | *Temperature (°C)* | *Wind speed (m/s)* | *Humidity (%)* | *Curtailment* |
| Beginning October to middle March | 2 hours after sunset, up to 7 hours before sunrise | Above 15 °C | Below 10 m/s | Between 40% and 70% humidity | Raise cut-in speed to 7 m/s |

## 12.1 Summary of Findings

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Medium Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Succulent Karoo, is high and the negative impact on bats during the operational phase could thus be high. This must be confirmed during operational bat monitoring, but the developer should prepare for turbine specific curtailment and/or installing bat deterrents when more information is available.

| **Summary of impacts on bats from the Patatskloof WEF according to the SiVEST impact significance rating** | | |
|---|---|---|
| *Phase* | *Impact before mitigation (negative)* | *Impact after mitigation (negative)* |
| Construction | 29 (5-23) Medium | 16 (5-23) Low |
| Operation | 38 (24-42) Medium | 29 (24-42) Medium |
| Decommissioning | 16 (5-23) Low | 7 (5-23) Low |
| Cumulative | 63 (62-80) Very High | 43 (43-61) High |
| Combined for the site | 36 (24-42) Medium | 24 (24-42) Medium |

As expected in an area where several back-to-back wind farms are developed, cumulative impacts on bat populations before mitigation are predicted to be High Negative, specifically when the threshold for bats in the Succulent Karoo is considered. Even with mitigation measures, the cumulative impact is expected to be High Negative. This has been confirmed by the general estimated mortality (GenEst) through carcass searches on operating wind farms in the Succulent Karoo. Despite the negative cumulative impact, this is not considered to be a fatal flaw if all the wind farms apply appropriate mitigation measures.

It is recommended that the following mitigation measures be included in the Environmental Authorisation (EA):

- The final layout must be informed by the sensitivity map provided in Section 7 of the main report, and turbine positions must avoid no-go and high sensitivity zones.
- A bat specialist must be appointed before the commercial operation date (COD).
- A mitigation scheme, as per Section 9 in the main report, must apply to operational turbines from the start, after turbines have been tested and have started to turn.
- Turbines must be feathered below cut-in speed, and although they need not be at a complete standstill, there should be minimum movement so that bats are not at risk when turbines are not generating power.
- All newly built structures that have bat conducive features must be rehabilitated to discourage bat presence. This includes roofs of new buildings, open quarries and borrow pits.
- A minimum of two year's operational bat monitoring must be conducted after commencement of operations at the WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

It should be noted that one year of pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Succulent Karoo environment is subject to erratic weather conditions, which vary from year to year. These changes usually result in changes in the bat situation which might not have been observed in this survey. This is not a limitation which would greatly affect the results of this bat monitoring programme, especially seen in the light of relatively good rainfall during the monitoring period.

The overall potential negative impact of the proposed Patatskloof WEF on bats, combined for all the development phases, is predicted to be Medium Negative without mitigation. The combined impact remains overall Medium Negative with mitigation, but the significance rating is lower.

**Based on the findings of the one-year pre-construction monitoring undertaken at the proposed Patatskloof WEF project site, the bat specialist is of the opinion that no fatal flaws exist which would prevent the construction and operation of the WEF. EA may thus be granted, subject to the implementation of the recommendations made in this report.**

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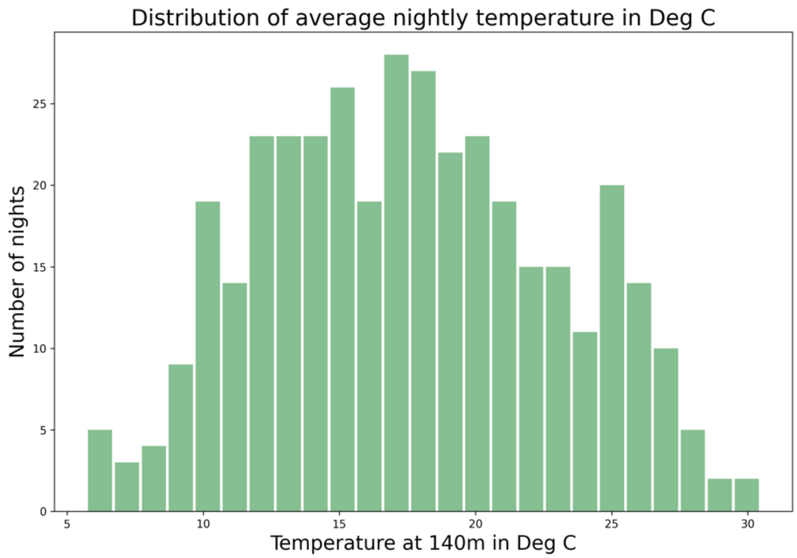
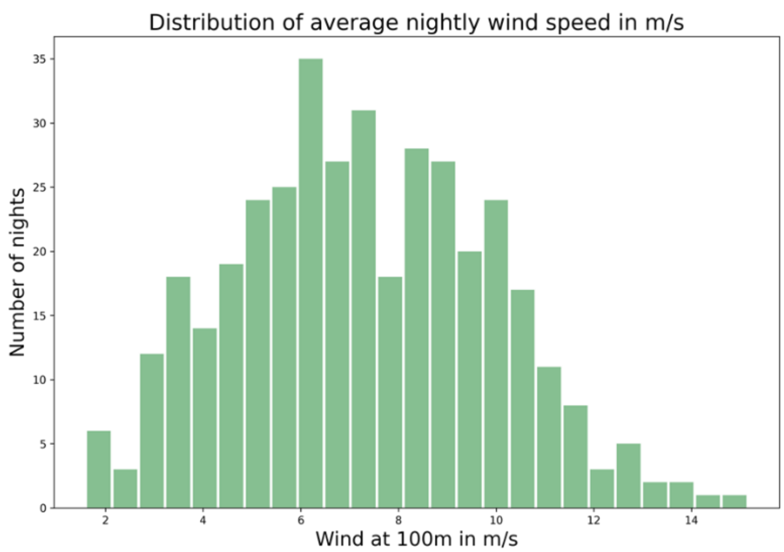
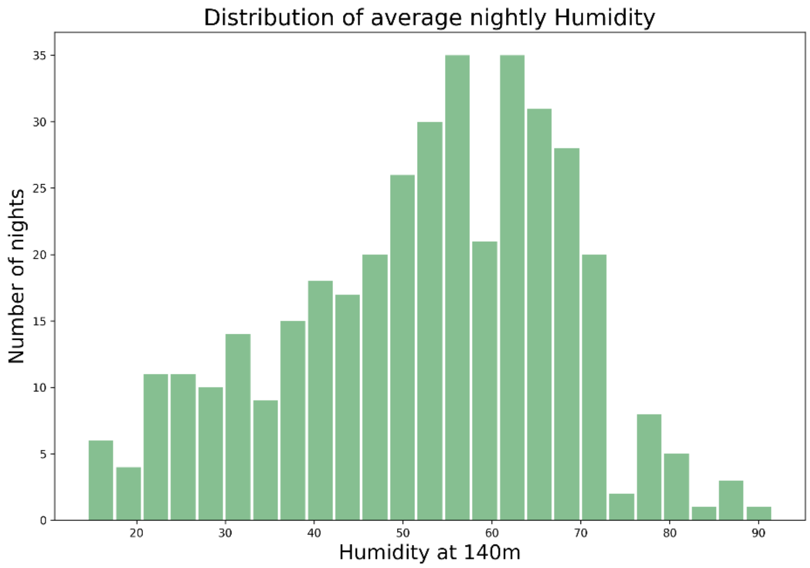
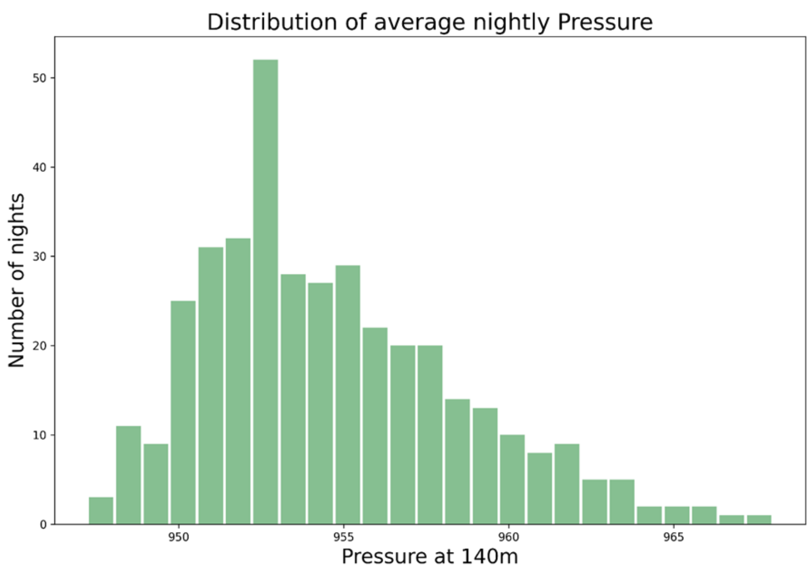
# APPENDIX 1: WEATHER DISTRIBUTIONS OF AVERAGE NIGHTLY WEATHER CONDITIONS


Distribution of average nightly temperature in Deg C
Number of nights
Temperature at 140m in Deg C
0
5
10
15
20
25
5
10
15
20
25
30


Distribution of average nightly wind speed in m/s
Number of nights
Wind at 100m in m/s
0
5
10
15
20
25
30
35
2
4
6
8
10
12
14


Distribution of average nightly Humidity
Number of nights
Humidity at 140m
0
5
10
15
20
25
30
35
20
30
40
50
60
70
80
90


Distribution of average nightly Pressure
Number of nights
Pressure at 140m
0
10
20
30
40
50
950
955
960
965

# APPENDIX 2: SPECIALIST CV

# *ABBREVIATED CURRICULUM VITAE*: STEPHANIE CHRISTIA DIPPENAAR

*Stephanie Dippenaar Consulting, trading as Ekovler*

## PROFESSION: ENVIRONMENTAL MANAGEMENT, SPECIALISING IN BAT IMPACT ASSESSMENTS

**Nationality**: South African
**ID number**: 6402040117089

**CONTACT DETAILS**


| | |
|---|---|
| Postal Address: | 8 Florida Street, Stellenbosch, 7600 |
| Telephone Number: | 021-8801653 |
| Cell: | 0822005244 |
| e-mail: | sdippenaar@snowisp.com |


**EDUCATION**

| | |
|---|---|
| 1986 | BA University of Stellenbosch |
| 1987 | BA Hon (Geography) University of Stellenbosch |
| 1999 | MEM (Masters in Environmental Management) University of the Free State |

**MEMBERSHIPS**

- Steering committee of The South African Bat Assessment Association
- Member of the Southern African Institute of Ecologists and Environmental Scientists (SAIEES), since 2002.
- SACNASP registration in process.

**EMPLOYMENT RECORD**

- 1989: The Academy: University of Namibia. One-year contract as a lecturer in the Department of Geography.
- 1990: Windhoek College of Education. One-year contract as a lecturer in the Department of Geography.
    - Research assistant, Namibian Institute for Social and Economic Research, working on, amongst others, a situation analyses on women and children in Namibia, contracted by UNICEF.
    - Media officer for Earthlife African, Namibian Branch.
- 1991: University of Limpopo. One-year contract as a lecturer in the Department of Environmental Sciences.

- 1992: Max Planc Institute (Radolfzell-Germany). Mainly involved in handling birds and assisting with aviary studies.
- Swiss Ornithological Institute. Working in the Arava valley, Negev – Israel, as a radar operator on a project, contracted by Voice of America, involved in an Impact Assessment Study concerning shortwave towers on bird migration patterns.
- 1993 - 2004: University of Limpopo. Lecturer in the sub-discipline Geography, School of Agriculture and Environmental Sciences. Teaching post- and pre-graduate courses in environment related subjects in the Faculty of Mathematics and Natural Sciences, Faculty of Law, Faculty of Health and the Water and Sanitation Institute.
  - 2002-2004: Member of the Faculty Board of the Faculty of Natural Sciences and Mathematics.
  - 2002: Principal investigator of the Blue Swallow project, Northern Province, Birdlife SA.
  - 2002: Evaluating committee for the EMEM awards (award system for environmental practice at mines in South Africa)
  - 2001-2004: Private consultancy work, focussing on environmental management plans for game reserves.
- 2004-2011: CSIR, South Africa, doing environmental strategy and management plans and environmental impact assessments, mainly on renewable energy projects.
- 2011 onwards: Sole proprietor private consultancy.
- From 2015 to 2017: Teaching a part-time course in Environmental Management to Post-graduate students at the Department of Geography and Environmental Studies, University of Stellenbosch.

## PROJECT EXPERIENCE RECORD

The following table presents an abridged list of project involvement, as well as the role played in each project:

| Completion | Project description | Role |
|---|---|---|
| In progress | Preconstruction Bat monitoring at Khoe Wind Energy Facility | Bat specialist |
| In progress | Preconstruction Bat monitoring at Hugo Wind Energy Facility | Bat specialist |
| In progress | Operational bat monitoring at Roggeveld Wind Farm | Bat specialist |
| In progress | Operational bat monitoring at Kangnas Wind Farm | Bat specialist |
| In progress | Operational bat monitoring at Perdekraal East Wind Farm | Bat specialist |
| 2022 | Preconstruction Bat monitoring at Juno 2 and Juno 3 Wind Energy Facilities | Bat specialist |
| 2022 | Background study for the impact on bats by Small Scale Wind Turbines in Cape Town Municipality | Bat specialist |
| In progress | Preconstruction Bat monitoring at Patatskloof Wind Energy Facility | Bat specialist |
| In progress | Preconstruction Bat monitoring at Karee Wind Energy Facility | Bat specialist |
| In progress | Operational bat monitoring at Excelsior Wind Farm | Bat specialist |
| 2021 | Preconstruction Bat monitoring at Koup 1 and Koup 2 Wind Energy Facilities | Bat specialist |

| Completion | Project description | Role |
|---|---|---|
| In progress | Preconstruction bat monitoring for two wind energy facilities at Kleinzee | Bat specialist |
| 2021 | Preconstruction bat monitoring at Komas and Gromis Wind Energy Facilities | Bat specialist |
| In progress | Preconstruction Bat monitoring at Kappa 1 and 2 Wind Energy Facilities | Bat specialist |
| 2020 | Preconstruction Bat monitoring at Kokerboom 3 and 4 Wind Energy Facilities | Bat specialist |
| 2020 | Operational bat monitoring at Khobab Wind Farm | Bat specialist |
| 2020 | Operational bat monitoring at Loeriesfontein 2 Wind Farm | Bat specialist |
| In progress (year 5) | Operational bat monitoring at the Noupoort Wind Farm | Bat specialist |
| 2019 | Paalfontein bat screening study | Bat specialist |
| 2019 | 12 Amendment reports | Bat specialist |
| 2019 | Preconstruction bat impact assessment for the Bosjesmansberg WEF | Bat specialist |
| 2018 | Preconstruction Bat Monitoring at the Tooverberg Wind Energy Facility | Bat specialist |
| 2016 | Bat “walk through” for the Hopefield Powerline associated with the Hopefield Community WEF | Bat specialist |
| 2016 | Environmental Management Plan for Elephants in Captivity at the Elephant Section, Camp Jabulani, Kapama Private Game Reserve. | Project Manager |
| 2016 | Environmental Management Plan for Hoedspruit Endangered Species Centre, Kapama Game Reserve. | Project Manager |
| 2012-2013 | Bat impact assessment for the Karookop Wind Energy Project EIA. | Bat specialist |
| 2012 | Bat specialist study for Vredendal Wind Farm EIA. | Bat specialist |
| 2011-2012 | Bat monitoring and bat impact assessment for the Ubuntu Wind Project EIA, Jeffreys Bay. | Bat specialist |
| 2011 | Bat specialist study for the Banna Ba Pifhu Wind Energy Development, Jeffrey’s Bay . | Bat specialist |
| 2011(project cancelled) | Basic Assessment for the development of an air strip outside Betty’s Bay. | Project Manager |
| 2011 | Bat specialist study for the wind energy facility EIA at zone 12, Coega IDZ, Port Elizabeth. | Bat specialist |
| 2010-2011 | Bat specialist study for the Wind Energy Facility EIA at Langefontein, Darling. | Bat specialist |
| 2010-2011 | Bat specialist study for the EIA concerning four wind energy development sites in the Western Cape. | Bat specialist |
| 2010 | Bat specialist study for Electrawinds Wind Project EIA, Port Elizabeth. | Bat specialist |
| 2010 | Environmental Management Plan for the Goukou Estuary. | Project Manager |
| 2010 | EIA for the 180MW Jeffrey’s Bay Wind Project, Eastern Cape (Authorisation received). | Project Manager |
| 2010 | EIA for 9 Wind Monitoring Masts for the Jeffrey’s Bay Wind Project (Authorisation received). | Project Manager |

| Completion | Project description | Role |
|---|---|---|
| 2009-2010 | EIA for the NamWater Desalination Plant, Swakopmund (Authorisation received). | Project Manager |
| 2007 -2011 | EIA for the proposed Jacobsbaai Tortoise reserve, Western Cape(Letf CSIR before completion of project, Authorisation rejected). | Project Manager |
| 2007-2008 | Environmental Impact Assessment for the Kouga Wind Farm, Jeffrey's Bay, Eastern Cape (Authorisation received). | Project Manager |
| 2006-2008 | Site Selection Criteria for Nuclear Power Stations in South Africa. | Co-author |
| 2005 | Auditing the Environmental Impact Assessment process for the Department of Environment and Agriculture, Kwazulu Natal, South Africa | Project Manager |
| 2005 | Background paper on Water Issues for discussions between OECD countries and Developing Countries. | Author |
| 2005 | Integrated Environmental Education Strategy for the City of Tshwane. | Co- author |
| 2005 | Developing a ranking system prioritizing derelict mines in South Africa, steering the biodiversity section. | Contributor |
| 2005 | Policy and Legislative Section for a Strategy to improve the contribution of Granite Mining to Sustainable Development in the Brits-Rustenburg Region, North-West Province, South Africa. | Author |
| 2005 | Environmental Management Plan for the purpose of Leopard permits: Dinaka Game Reserve. | Project Manager in collaboration with Flip Schoeman✞ |
| 2004 | Environmental Management Plan for the introduction of lion: Pride of Africa. | Project Manager in collaboration with Flip Schoeman✞ |
| 2004 | Environmental Management Plan for the establishment of a Conservancy: Greater Kudu Safaris | Project Manager in collaboration with Flip Schoeman✞ |

## MEMBERSHIPS, CONFERENCES, WORKSHOPS AND COURSES

- Member of the Steering Committee of the South Africa Bat Assessment Association.
- Active member of the KZN Bat Rescue Group, assisting rescue bats and bat problems in buildings of residential areas.
- Updated Basic Fall Arrest certification.
- Presenting a paper at the South African Bat Assessment Association conference, October 2017: Ackerman, C and S.C Dippenaar, 2017: Friend or Foe? The Perception of Stellenbosch Residents Towards Bats, 2017.
- Attend Snake Awareness, Identification and Handling course by Cape Reptile Institute, 2016.
- Attend a course in the management and care of bats injured by wind turbines by Dr. Elaenor Richardson, Kirstenbosch, 27 August 2014
- Mist netting and bat handling course by Dr. Sandie Sowler, Swellendam, 5 November 2013.
- Attendance and fieldwork to identify bat species and look at new AnalookW software with Chris Corben, the writer of the Analook bat identification software package and the Anabat Detector, during 10 and 11 October 2013.

- Attend yearly Bats and Wind Energy workshops.
- A four-day training course on Bat Surveys at proposed Wind Energy Facilities in South Africa, hosted by The Endangered Wildlife Trust, Greyton, between 22 and 26 January 2012.
- Presentation as a plenary speaker at the 4th Wind Power Africa Conference and Renewable Energy Exhibition, at the Cape Town International Convention Centre, on 28 May 2012. Title: *Bat Impact Assessments in South Africa: An advantage or disadvantage to wind development EIAs.*
- Anabat course by Dr. Sandy Sowler, Greyton, February 2011.
- Attending a Biodiversity Course for Environmental Impact Assessments presented by the University of the Free State, May 2010.

**LANGUAGE CAPABILITY**

Fluent in Afrikaans and English, very limited Xhosa

**PEER REVIEWED PUBLICATIONS**

Dippenaar, S, and Lochner, P (2010): EIA for a proposed Wind Energy Project, Jeffrey's Bay in SEA/EIA Case Studies for Renewable Energy.

Dippenaar, S. and Kotze, N. (2005): People with disabilities and nature tourism: A South African case study. Social work, 41(1), p96-108.

Kotze, N.J. and Dippenaar, S.C. (2004): Accessibility for tourists with disabilities in the Limpopo Province, South Africa. In: Rodgerson, CM & G Visser (Eds.), Tourism and Development: Issues in contemporary South Africa. Institute of South Africa.

**REFERENCES**

| | |
|---|---|
| ***Chris van Rooyen***<br>**Bird specialist: Director of AfriImage Photography trading as Chris van Rooyen Consulting**<br><br>***Contact Details:***<br>**Email: vanrooyen.chris@gmail.com**<br>**Mobile: +27824549570** | ***Brent Johnson***<br>**Vice President: Environment at Dundee Precious Metals**<br><br>***Contact Details:***<br>**email: b.johnson@dundeeprecious.com**<br>**Office: +264672234201**<br>**Mobile: +264812002361** |

# APPENDIX 3: SITE SENSITIVITY VERIFICATION

# Site Sensitivity Verification Report: Patatskloof Wind Energy Facility

# In terms of Part A of the Assessment Protocols published in GN 320 on 20 March 2020

## 1 INTRODUCTION

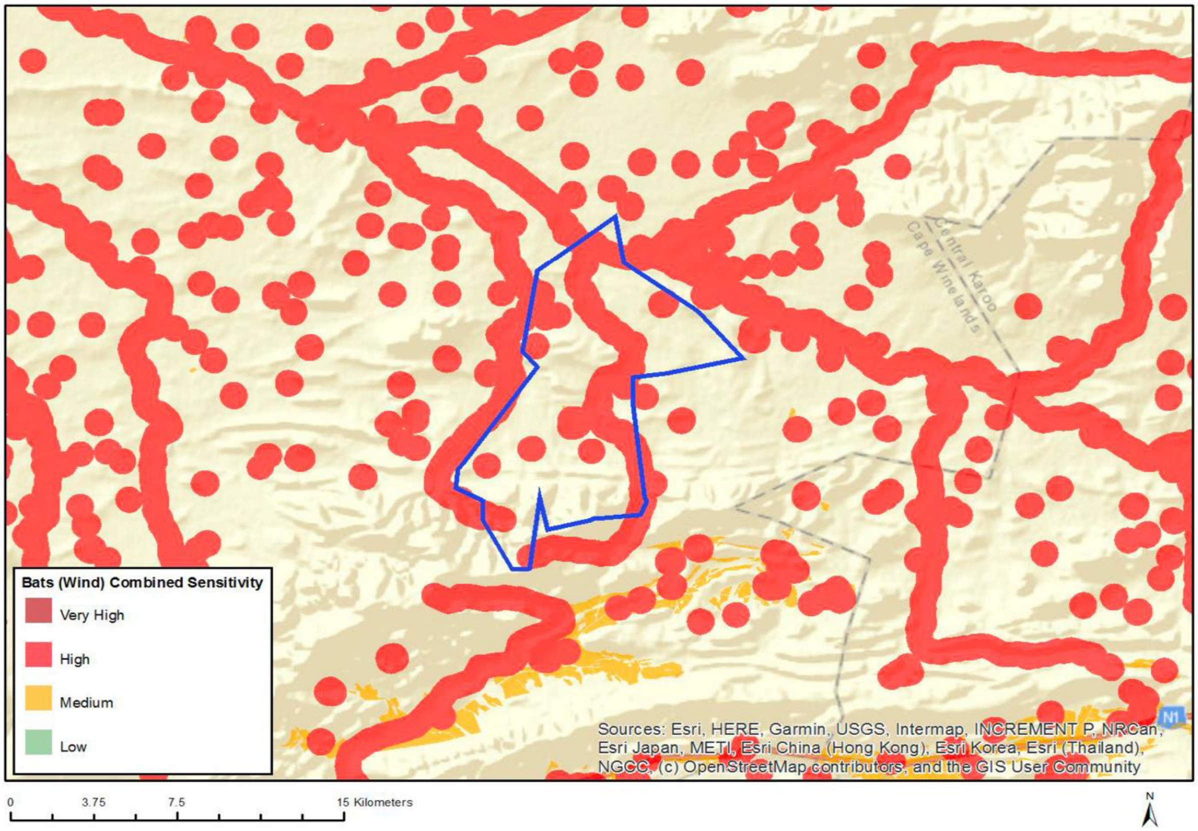
South Africa Mainstream Renewable Power Developments (Pty) Ltd, has appointed SiVEST SA (Pty) Ltd to undertake the required Basic Assessment (BA) Processes for the proposed construction of the 250 MW Karee Wind Energy Facility (WEF) and associated grid infrastructure near Touws River in the Western Cape Province. The project site is situated in the Komsberg Wind Renewable Energy Development Zone (REDZ) and is approximately 6 612 ha in extent. The proposed location of the Karee WEF itself covers a smaller area of around 2 905,4 ha within the project site.

Stephanie Dippenaar Consulting, trading as EkoVler, was appointed to undertake a Bat Impact Assessment, including a 12-month pre-construction bat monitoring programme, to inform the BA process for the proposed WEF. The pre-construction bat monitoring was conducted between 11 June 2021 and 27 June 2022.

According to the Specialist Assessment Protocols published in GN 320 on 20 March 2020, a site sensitivity verification has been undertaken to confirm the current land use and predict the environmental sensitivity of the proposed project area, as identified by the national web-based Environmental Screening Tool.

## 2 SITE SENSITIVITY VERIFICATION

The national web-based Environmental Screening Tool was applied to the study area, and it was determined that areas of high bat sensitivity are expected to occur within the project site, as shown in Figure A below.




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | X | | |

***Figure A: Expected bat-sensitivity at the Patatskloof WEF site, as per the Site Sensitivity Report***

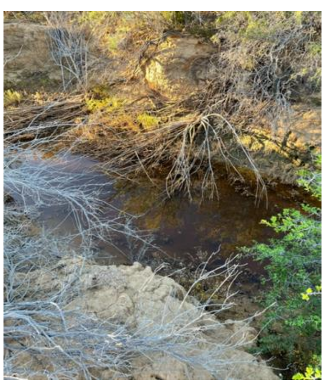
The following methods were applied during the 12-month pre-construction bat monitoring exercise to verify this classification:

- A desktop analysis was undertaken, utilising available national and provincial databases, existing reports from the surrounding area, as well as digital satellite imagery (Google Earth Pro and QGIS).
- Onsite inspections and roost searches were conducted by a bat specialist during fieldwork sessions.
- Data recording nightly bat activity was collected for 12 months from five static monitoring points, which were positioned amongst the proposed turbine blades at heights of 10 m, 12 m, 55 m, and 105 m respectively. The systems represented the different biotopes within the project site.
- Interviews with landowners and investigations of farm dwellings were conducted.

# 3 THE OUTCOME OF THE SITE SENSITIVITY VERIFICATION

See Table A below for photos indicating bat conducive features at the proposed Patatskloof WEF project site.

***Table A: Environmental features that may be favourable to bats at Patatskloof WEF***

| | |
|---|---|
|  | **Vegetation**<br>Most of the project site is covered in the Karoo vegetation typical of the area. Trees situated in several riverbeds and ravines could provide ample roosting opportunities for those bats that might prefer roosting in vegetation or under the bark of trees. Clutter and clutter-edge foragers may also prefer to forage in the relatively denser vegetation and the valleys could serve as flight paths for such bats. |
|  | **Rock formations and rock faces**<br>Rock formations in the mountainous in the southern part of the site and the steep valley sides of the central ravine provide many roosting opportunities for bats. |
|  | **Open water and food sources**<br>Water troughs for the livestock, farm dams and water collecting in the riverbeds not only provide bats with water to drink but also promote insect activity which could result in relatively higher bat activity after rainy spells. |

| | |
|---|---|
|  | Derelict aardvark holes could serve as roosting opportunities for some bat species. |

As indicated in the Screening Tool Site Sensitivity Map, Figure A, the project site is classified as high sensitivity, partly due to the presence of numerous riverbeds. Near-ground and high-altitude bat activity is in the upper class of the bat activity threshold for Succulent Karoo (MacEwan, et al. 2018), thereby confirming the classification of the site as high sensitivity. Figure A is based on the Site Sensitivity Tool which indicates some of the riverbeds which suggest sensitive areas, but the southern part with relatively dense vegetation and numerous rock formations in the mountainous areas, are not depicted on the map.

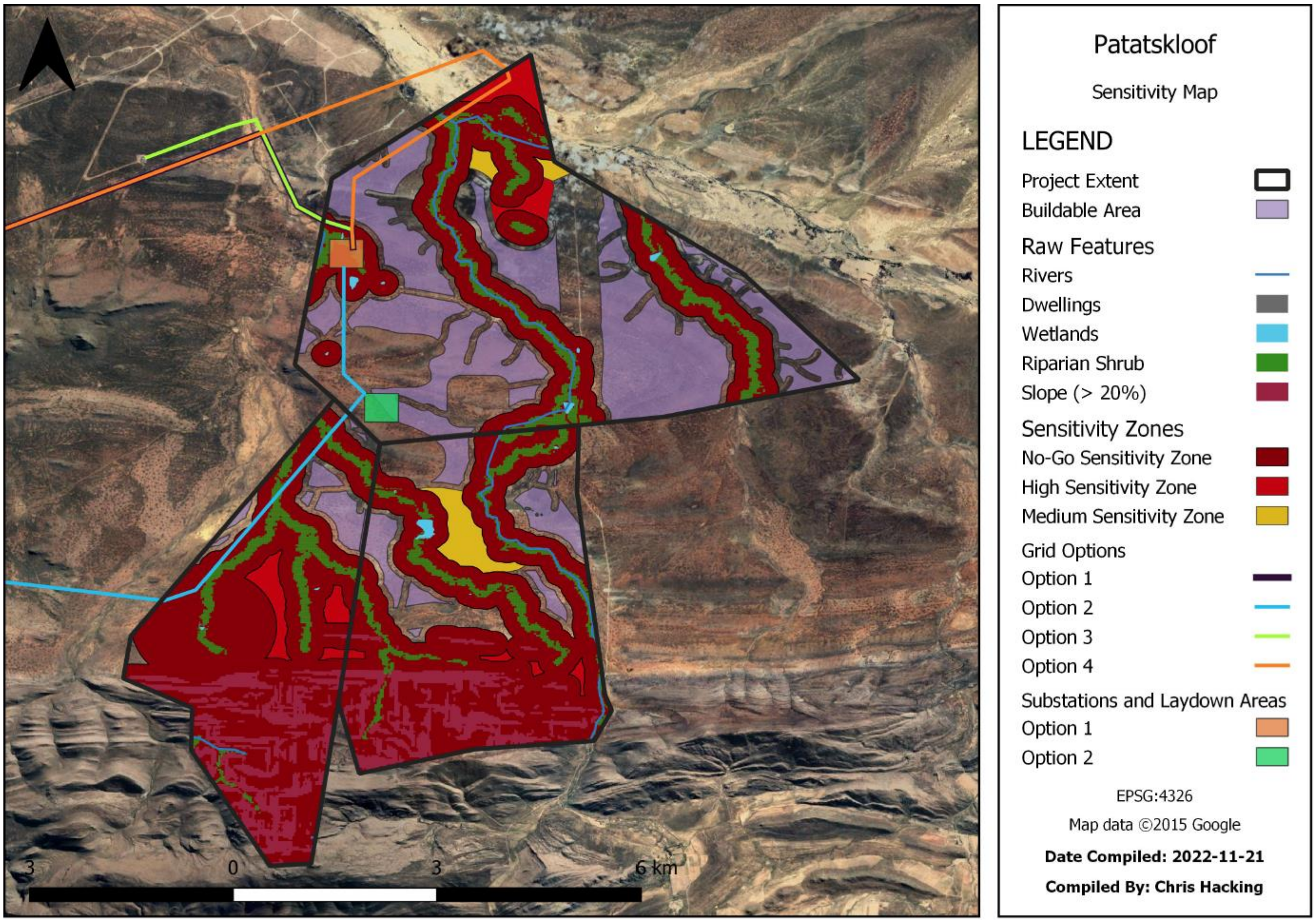



***Figure B: Bat Sensitivity Map at the Patatskloof WEF site, as confirmed during the 12-month bat monitoring period***

## 4 CONCLUSION

The Site Sensitivity Verification Report indicates the Patatskloof WEF area as having high bat sensitivity. The various drainage lines are particularly conducive to bat activity. This is confirmed by the 12-month bat monitoring study. In addition to what is portrayed on the Site Verification Report Map, the southern and northern areas are also high bat activity environments, with the mountainous areas in the south and the Grootrivier in the north. These areas are classified as high sensitivity areas in the Bat Monitoring Report and are therefore identified as 'no-go' areas for development, as shown in Figure B above. In line with the SABAA Bat Threshold Document for Succulent Karoo (MacEwan, et al. 2018), the bat activity at the proposed project site is generally high near ground as well as within the sweep of the turbine blades. A more in-depth discussion supporting this conclusion is presented in Section 6 and 7 of the report to which this annexure is attached.

# APPENDIX 3: SPECIALIST DECLARATION

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

**Patatskloof Wind Energy Facility, near Touwsrivier, Western Cape**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Stephanie Dippenaar Consulting trading as EkoVler | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | 5 | Percentage Procurement recognition | 80% |
| Specialist name: | Stephanie C Dippenaar | | | |
| Specialist Qualifications: | MEM (Masters in Environmental Management) | | | |
| Professional affiliation/registration: | SAIEES (Southern African Institute for Ecologists and Environmental Scientists) | | | |
| Physical address: | 8 Florida Street, Stellenbosch | | | |
| Postal address: | 8 Florida Street, Stellenbosch | | | |
| Postal code: | 7600 | Cell: | 082 200 5244 | |
| Telephone: | 082 200 5244 | Fax: | | |
| E-mail: | sdippenaar@snowisp.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Stephanie C Dippenaar, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Stephanie Dippenaar Consulting trading as EkoVler

Name of Company:

21 September 2022

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

### 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Stephanie C Dippenaar, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Stephanie Dippenaar Consulting trading as EkoVler

Name of Company

21 September 2022

Date

Signature of the Commissioner of Oaths

SUID-AFRIKAANSE POLISIEDIENS

Date 2022 -09- 21

STATION COMMANDER

SOUTH AFRICAN POLICE SERVICE