Bat Monitoring Report for the Proposed Construction of the Heuweltjies 240 MW Wind Energy Facility within the Prince Albert Local Municipality, Western Cape Province, South Africa

July 2023

SiVEST SA (PTY) LTD

BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE HEUWELTJIES 240 MW WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE, WITHIN THE PRINCE ALBERT LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA

FINAL REPORT

TITLE:	BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE HEUWELTJIES 240 MW WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, WITHIN THE PRINCE ALBERT LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA
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BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE HEUWELTJIES UP TO 240 MW WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, WITHIN THE PRINCE ALBERT LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA

EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter called Mainstream) proposes the construction of up to a 240 megawatt (MW) Wind Energy Facility (WEF) at the Heuweltjies WEF site. The project is located on the remainder of the Farm Witpoortje No.16 and Portion 8 of the Farm Klipgat No.114, within the Prince Albert Local Municipality in the Central Karoo District Municipality, en route to Beaufort West, in the Western Cape Province.

SiVEST SA (PTY) LTD (hereafter known as SiVEST) is undertaking the prerequisite environmental impact assessment application for this project. **Stephanie Dippenaar Consulting**, trading as **EkoVler,** has been appointed to assess the potential impact of the proposed development on bats in the area and to inform final design and management strategies by identifying measures that would mitigate direct, indirect, and cumulative impacts of the development and associated infrastructure. The bat specialist will also provide mitigation recommendations for inclusion in the Environmental Management Program (EMPr).

The proposed Heuweltjies WEF is not situated close to any formally protected areas; however, beyond the site and more than 40km south of the border of the development, near the Swartberg mountains, there are several protected areas. The Henry Kruger Private Reserve, approximately 45 km to the northwest, is the nearest registered reserve, and the Karoo National Park is less than 60 km to the north. Regionally, the development falls within the Lower Karoo Bioregion, and more specifically within the Nama Karoo Biome, where the Gamka Karoo is the single dominant vegetation type.

A limited number of trees situated in the non-perennial riverbeds and around human dwellings could provide roosting opportunities for bats that prefer roosting in vegetation or under the bark of trees. Limited rock formations along the river valleys, as well as abandoned burrows, such as aardvark holes, also provide roosting opportunities for bats. Culverts, stone walls and human dwellings, where roofs are not sealed off, could provide additional roosting opportunities for some bat species. Water troughs for the livestock, open dams and cement reservoirs provide permanent, open water sources for bats throughout the year. During the few rainy spells, stagnant water that collects in small pans and usually dry ditches could serve as breeding ground for insects which is a food source for bats. The Heuweltjies site is used as grazing for free-range Angora goats and livestock tends to attract flies, which could also serve as a food source for bats.

Data from passive monitoring systems, transects, roost surveys and a desktop study informed this report. Four static SM4BAT systems were deployed within the project site between 15 August 2021 and 12 November 2022, with two systems located near-ground, namely Systems L and M (at 8 m and 10 m respectively) and Systems J and K (at 98 m and 52 m respectively).

Five of the 12 bat species which have distribution maps overlaying the proposed WEF were recorded during the bat monitoring. According to the likelihood of fatality risk, as indicated in the latest pre-construction guidelines, four of these species have a high risk of fatality, with one species having a medium risk of fatality.

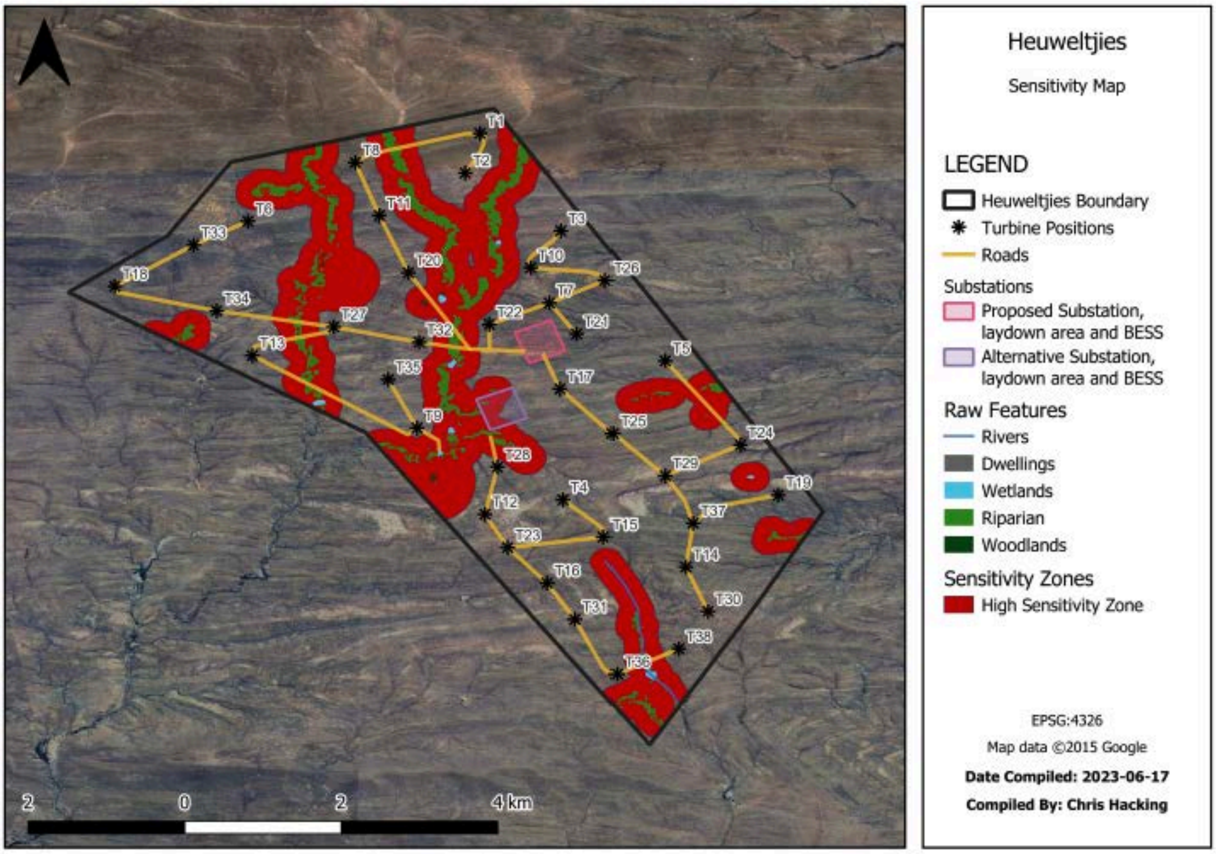
76% of the calls at all the systems represent *Tadarida aegyptiaca*, which is the dominant species on site. This is a high-risk species, physiologically adapted, with a narrow wingspan, to fly high in the vicinity of the turbine blades where the risk of collision and barotrauma is high. 16% of the activity was from calls like that of *Neoromicia capensis,* 8% was for *Sauromys petrophilus,* while statistically insignificant numbers of the endemic *Eptesicus hottentotus* and the Near Threatened *Miniopterus natalensis* were also recorded at the site. The Molossidae family is more dominant at the high-altitude systems, with the Molossids *S. petrophilus* and *T. aegyptiaca* comprising nearly 100% of all the activity recorded at height (Systems J and K).

The proposed Heuweltjies WEF recorded low bat activity during winter, between May and August, with a steady increase in activity from September (spring) to late summer (February) and the beginning of autumn (March). The highest activity was experienced between January and March. The relatively high activity in September 2022 was not portrayed again in September 2021, which could have been due to a later onset of warmer spring temperatures during 2021.

The general distribution of bat activity each night, from sunset to sunrise, indicates a steady increase in activity from sunset, with bat activity rising steadily until a peak around midnight, whereafter activity declined up to about four hours before sunrise, with little activity thereafter. Apart from a relatively higher peak earlier in the evening at the 98 m system, all the systems indicate the same pattern of activity with small variations. This could imply a fairly uniform nightly activity pattern over the site as a whole.

The combined median bat activity per hour at the near-ground level is 0,85, while the combined median bat activity per hour within the rotor sweep area is 0,42. Although, according to the SABAA guidelines, these are both within the medium-risk category, the rotor sweep activity of 0,42 bats per hour is on the border of medium and high risk. The rotor sweep median is of particular importance, as this represents the overall hourly bat activity within the proposed sweep of the turbine blades, and thus in the area of expected collision risk. It is therefore recommended that operational bat monitoring establish whether bat activity in the rotor-sweep area consistently remains within the medium risk category with changing weather conditions.

Data from the 98 m System J and 52 m System K 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 10 °C, wind speeds below 11 m/s and humidity levels between 40% and 70%. A bat sensitivity map which designated high sensitivity areas is presented below. The client has already applied mitigation by shifting all turbine positions outside of high sensitivity zones, so that no operating turbine components are placed in these areas. Supporting infrastructure, such as the roads, laydown area, on-site sub-station and the Battery Energy Storage System may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any destruction of possible bat roosts, as per the EMPr.



Although no curtailment is recommended at present, a curtailment schedule is presented in Section 9.3, Table 9, of the main document. This must be included in the operational bat monitoring program so that the operational bat specialist can adapt mitigation measures and include these recommendations as necessary.

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Low Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Nama Karoo, is medium. This must be confirmed during bat monitoring in the operational phase, but the developer should not rule out turbine-specific curtailment and/or installing bat deterrents when more information is available.

As indicated in the table below, the impact on bats from the proposed Heuweltjies WEF project site is predicted to be Negative Medium, with a combined rating of 34,1 before mitigation and Negative Low, with a combined rating of 21,8 after mitigation.

Summary of impacts (average of each section) on bats by the proposed Heuweltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24 (5-23) Medium	7(5-23) Low
Construction	23 (5-23) Low	6,7 (5-23) Low
Operation	36 (24-42) Medium	22,8(5-23) Low
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	45,6 (62-80) High	35,8 (24-42) Medium
Combined for the site	34,1 (24-42) Medium	21,8 (5-23) Low

The cumulative impacts on bat populations at the proposed Heuweltjies WEF, before mitigation, are predicted to be High Negative. This is due to the combined impact of all the proposed wind farms in the area. If all wind farms in the vicinity adhere to recommended mitigation measures, the combined cumulative impact is predicted to be reduced to Medium.

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 above and in Section 7 of the main report.
- A bat specialist must be appointed before the Commercial Operation Date (COD). A mitigation scheme, as per Section 9 in the main report, must form part of the operational EMPr, and be applied on site.
- 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.
- Mitigation measures must be applied as outlined in the impact tables, Section 10, of the main report and the EMPr.
- Should high fatality rates, above the fatality threshold of the relevant guidelines, be experienced during operation , curtailment, as indicated in Section 9 of the main report, must be adapted, or bat deterrents must be installed, as guided by the operational bat specialist.
- 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 regular investigation should establish if new roofs are still sealed.
- A minimum of two year's operational bat monitoring must be conducted after the commencement of operations at the proposed WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

The Site Sensitivity Verification Report indicates that the area proposed for the proposed Heuweltjies WEF has areas of high bat sensitivity. Some of the drainage lines, with relatively large trees and dense bushes, are particularly conducive to bat activity, as confirmed in the Site Sensitivity Verification Report. However, according to the SABAA bat threshold, the site as a whole, with the data from the monitoring period, is indicated as medium sensitive. Areas between the high sensitivity zones portrayed lower activity and are therefore available for turbine development.

It should be noted that one year pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Nama Karoo environment is subject to erratic weather conditions, which vary from year to year. As confirmed by operational wind farms, bat fatalities could fluctuate significantly, depending on weather conditions. These changes cannot be accounted for in a year of bat monitoring.

The overall potential negative impact of the proposed Heuweltjies WEF on bats, combined for all the development phases, is predicted to be **Medium Negative without mitigation**, and **Low Negative with mitigation**.

Based on the findings of the one-year pre-construction monitoring undertaken at the proposed Heuweltjies WEF project site that will be up to 240 MW in size, the bat specialist is of the opinion that no fatal flaws exist which would prevent the construction and operation of the WEF. Environmental Authorisation may thus be granted, subject to the implementation of the recommendations made in this report.

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- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.2 And Appendix 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 5.3, 8 and 10
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6
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 alternative;	Sections 3, 5 and 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 9, 10 and 11
k) any mitigation measures for inclusion in the EMPr;	Section 10.9
l) any conditions for inclusion in the environmental authorisation;	Section 10
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and 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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appendices

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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
CBA	Critical Biodiversity Area
CDF	Cumulative Distribution Function
COD	Commercial Operation Date
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
MW	Megawatt(s)
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

1. INTRODUCTION

Stephanie Dippenaar Consulting, trading as EkoVler, has been appointed to conduct a 12-month bat study for the proposed Heuweltjies up to 240 MW Wind Energy Facility (WEF) by South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter called Mainstream). The project is located on the remainder of the Farm Witpoortje No.16 and Portion 8 of the Farm Klipgat No.114, within the Prince Albert Local Municipality in the Central Karoo District Municipality, en route to Beaufort West, in the Western Cape Province.

This is the final report which provides an overview of the bat monitoring programme conducted at the proposed Heuweltjies up to 240 MW WEF from August 2021 to November 2022. This report includes a detailed statistical analysis of bat activity, such as results plotted against weather conditions.

The overall objective of the proposed WEF development is to generate electricity by means of renewable energy technology, capturing wind energy to feed into the national grid. The maximum total energy generation capacity will be up to approximately 240 MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132 kilovolt (kV) overhead power line (to form part of a separate Basic Assessment application, not included herein).

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 WEF development are considered listed activities under GNR 327 and GNR 324. These are activities which 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 the commencement of such activities. An Environmental Impact Assessment 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 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 (ToR), 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 impact;
- Section 9: Proposed mitigation measures;
- Section 10: Description of the project aspects relevant to the bat impact assessment;
- Section 11: Comparative assessment of alternatives; and
- Section 12 Conclusion and summary.

1.1 TERMS OF REFERENCE

The following ToR apply to bat monitoring on 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;
- Collecting details on how the surveys have been designed to determine the presence of rarer species; and
- 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 observed through the monitoring data and site visits.

1.2 BAT SPECIALIST TEAM

Stephanie Dippenaar, owner of Stephanie Dippenaar Consulting trading as EkoVler, has a track record of involvement in environmental management since 1991, and in particular environmental assessments, since 2003. She has managed several renewable energy project EIAs and has since 2010 started to specialise in bats. Stephanie has done some of the first bat studies for wind energy developments in South Africa and is at present involved in several pre-construction as well as operational bat monitoring studies.

Stephanie is a steering committee member of SABAA (South African Bat Assessment Association) and an active member of the National Bat Rescue Group. Dr Inus Grobler (D.Eng) provides technical support related to equipment and Inus Grobler Jr. (B.Com), a data analyst, supports statistical analysis of data. Jacob Claassen, The Lady Birds, who is a seasoned field worker and has worked on several wind farms with EkoVler, was the field assistant during the bat monitoring. Jacob is familiar with the bat monitoring protocol and with operating the SM4BAT ultrasonic recorders, which were used at the proposed site. Diane Erasmus (MSc), a seasoned EAP, and Franky Nightingale (MA Hon) provided support in the compilation of the bat monitoring reports.

1.3 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 Heuweltjies 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); and
- 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 exercise:

- A desktop study of available literature was conducted to establish which species occur in the area. This includes the surrounding area as well as information from other wind developments in the area, where accessible.
- Background information was provided regarding ecosystem services 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) of the proposed Heuweltjies WEF regarding possible bat occurrence on the property and the surroundings.
- Input from the bat specialist study is used to inform the turbine layout.
- Information was gathered from other wind farm developments in the close vicinity of the proposed Heuweltjies WEF site to assess the cumulative impact of each WEF.
- Potential impacts were identified and the potential significance thereof was predicted.
- Mitigation measures are recommended.

The methods of investigation of bats at the proposed wind farm development are described below.

1.3.1 Desktop investigation of the development area as well as the surrounding environment

A desktop study of the site was undertaken, using the information provided by Mainstream, as well as information gathered through a literature review. The literature reviewed included existing reports and other studies for the area, as well as the SANBI GIS database. Conservation areas in the vicinity were noted and information regarding bat monitoring from other developments in the area, particularly renewable energy projects and wind farms, were included to understand cumulative effects. Relevant guidelines and legislation were also consulted. The study area was visited to further inform the background assessment of the site. During fieldwork, physical surveys were conducted to identify the location of possible roosts. Interviews were also conducted with people staying on or close to the site, to establish if they were aware of any roosts in the vicinity, or general bat presence.

1.3.2 Passive Acoustic Monitoring Systems

Passive acoustic monitoring was conducted between August 2021 and November 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 four Wildlife Acoustics SM4BAT full spectrum bat detectors powered by 12 V, 7 Amp-h sealed lead acid batteries replenished by PV solar panels (see Table 1). Two SD memory cards, class 10 speed, with a capacity of 64 GB or 128 GB each, were used 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 Heuweltjies WEF site

Detector	Situation	Coordinates	Microphone	Division ratio	High pass filter	Gain	Format	Trigger window	Calibration (on chirp) at the microphone when deployed
SM4BAT (Met J)	Met mast: mic at 98 m	29°49'33" S 17°17'31" E	SMM-U2	8	16 kHz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to around -8 dB, when installed by Windhunter
SM4BAT (Met K)	Met mast: mic at 52 m	29°49'33" S 17°17'31" E	SMM-U2	8	16 kHz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to around -8 dB when installed by Windhunter
SM4BAT (Met L)	Temporary mast: mic at 10 m	32°52'09,8" S 22°25'06,1" E	SMM-U2	8	16 kHz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -8,8 dB at the microphone
SM4BAT (Mast M)	Temporary mast: mic at 10 m	32°59'25,9" S 22°36'53,6" E	SMM-U2	8	16 kHz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -8,62 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 (30 minutes) 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 three to four months and analysed to provide an approximation of the bat frequency and diversity of species that visit and/or inhabit the site.

The position of the Met mast, see **Error! Not a valid bookmark self-reference.**, was determined by the developer and the bat monitoring systems on the Met mast represent the biotope associated with the plains of the Gamkwa Karoo (SANBI, 2012) vegetation type. A number of factors informed the position of the temporary mast for the bat monitoring equipment. This included representation of the different biotopes on site, proximity to possible bat conducive areas and accessibility for installation of a mast.

The position of the 10 m mast, System M, represents the northern part of the windfarm. It is situated next to a non-perennial run-off and an open farm dam, which might attract bats when there is water in the dam. The farm is grazed by angora goats, and the droppings of livestock might attract some flies, which could serve as a food source for bats, see **Error! Not a valid bookmark self-reference.**

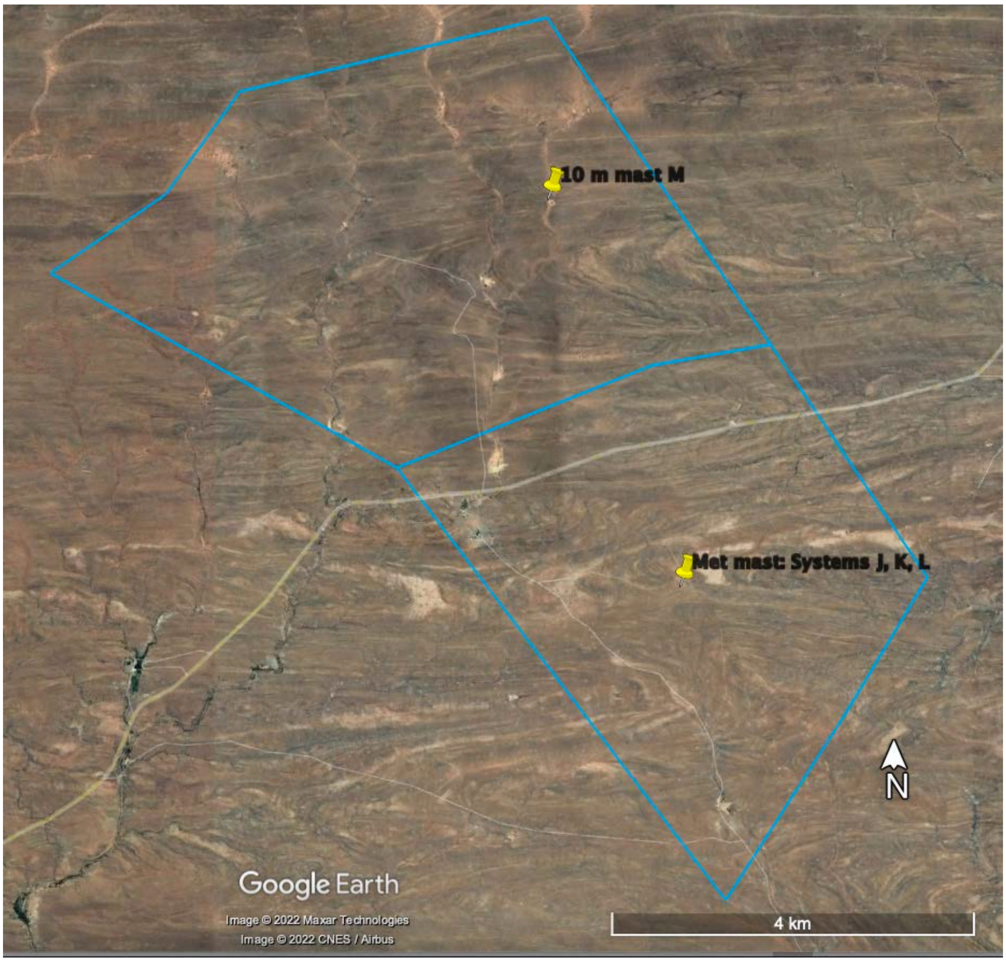


Figure 1: Positions of monitoring stations at the proposed Heuweltjies WEF

Figure 2: Monitoring Station M, the 10 m mast on the proposed wind farm site

1.3.3 Roost Surveys

Areas where roosts could be situated were investigated; however, it was not always possible to access all roosts in rock crevices or roofs with limited ceiling space. No day roosts were identified at the proposed Heuweltjies development site, but would day roosts be identified, bat counts are conducted at sunset and if deemed necessary, detectors are installed for short periods at point sources to monitor roosts. It should be noted that the site was large and within the time span and limitations of the bat monitoring study, searching the whole site for roosts was not possible. The site was walked and driven through to identify areas where one could expect bat roost. Those areas were then carefully investigated.

1.3.4 Driven transects

Transects provide a snapshot in time and could confirm bat species or activity for a specific night. A SM4BAT full spectrum recorder with the microphone mounted on a pole was used for transects; see Figure 3. 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. All transect routes are the same, as far as possible, so that seasonal data can be compared. More details about the transects are available in Section 6.

Figure 3: Microphone mounted on a vehicle for transects

1.3.5 Data Analysis

Data were downloaded manually approximately once every three to four months. Acoustic files downloaded from the detectors were analysed for bat activity with respect to the number of bat passes and the bat species. The latest version of Wildlife Acoustics Kaleidoscope Pro was used for analysing large quantities of data. In cases where there is uncertainty about details of a call (which is confirmed as a bat calling), the call was classified as Unclear.

1.3.6 Source of Information used in the Bat Impact Assessment

The following information sources were used to inform this study.

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 (Section 13).
- 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 were conducted with the landowners of the proposed WEF site during field work sessions or by telephone if they were not available on-site, to establish if they were 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.

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 (SANBI), 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.

1.4 IMPORTANCE OF BATS

Bats are the second largest group of mammals after rodents (Pennisi, 2020). Approximately 62 bat species occur in South Africa (De Villiers, 2022). 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 with a wing design adapted to flying fast and high above the vegetation, experience the highest negative impact from wind turbine developments. However, bats could change their flight characteristics when migrating, so that bats that usually forage at low altitudes could fly within the sweep of the turbine blades when migrating, regardless of their foraging behaviour.

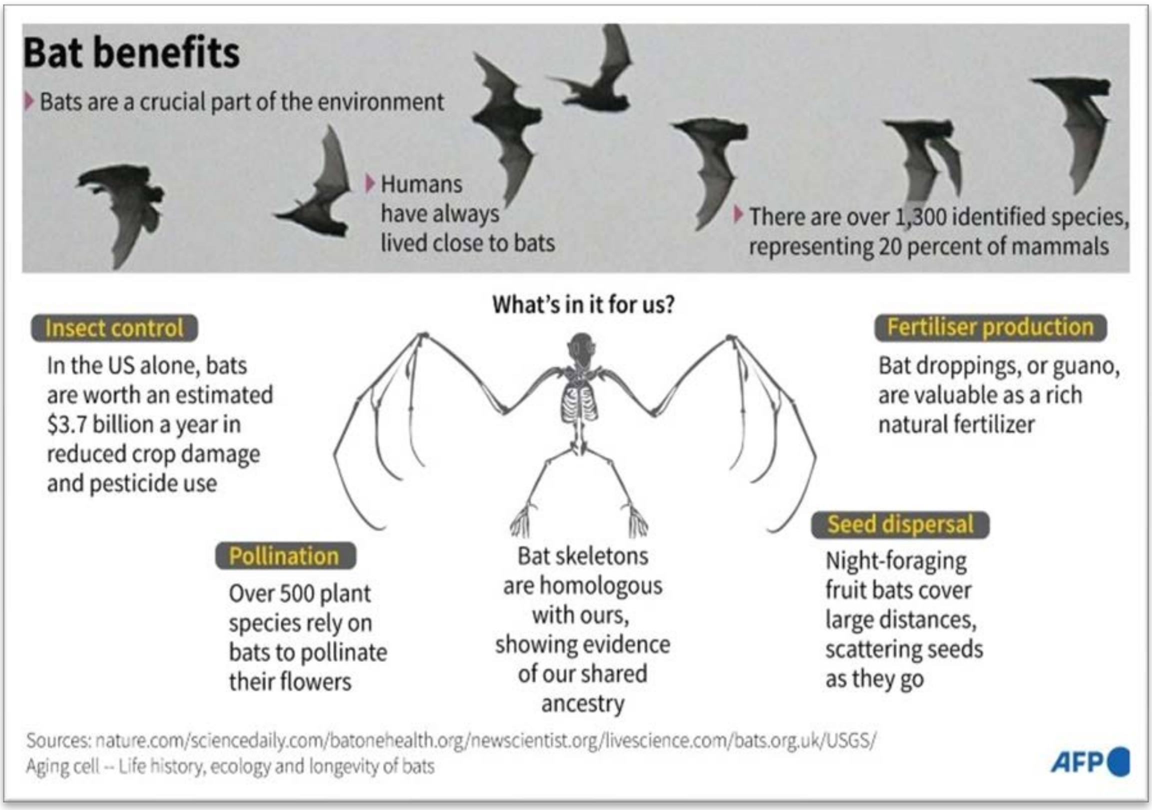


Figure 4: The importance of bats

Bats in general play important functional roles as insect predators, as well as pollinators and seed dispersers, in the case of fruit bats. Fruit bats are the main pollinators of numerous cacti species in the world because these plants open their flowers during the night (National Science Foundation, 2012), as shown in Figure 4.

In addition to the mortality and disturbance resulting from wind turbine developments, the major threats faced by bats include habitat destruction and change, roosting disturbance, and natural disasters (Geda and Balakrishnan 2013). Bat populations are sensitive to changes in mortality rates and tend to recover slowly from decline. In general, environment-related risks for bats associated with human behaviour include the reduction in food resources, overhunting of bats for bush meat, the maltreatment of bats due to misguided fears, such as those related to Covid-19, killing bats that roost in roofs, and a rise in the use 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 the widespread loss of bat populations could be substantial, even more so in 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. The cost of reduced pesticide usage stemming from bats controlling pests in the USA has been quantified, resulting in a saving of more than an estimated $3,7 billion (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 could consume large numbers of mosquitoes. They typically consume insects 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 in reducing 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 with navigating sonar systems (National Park Service, 2020; National Science Foundation, 2012). Further examples are base jumper wingsuits, sonar navigation for ships and ultrasound devices.

Blind people, as well as those that are visually impaired, use supporting equipment that emits echolocation to establish the position of an object (Science Daily, 2013). Researchers also assessed the saliva of vampire bats as practicable medication to treat strokes in humans (ESA, 2011), as the enzyme that prevents blood from coagulating when vampire bats feed can be used to prevent or to break down blood clots in stroke patients. The drug known as “Draculin” has since been derived.

1.5 DOMINANT BAT SPECIES AT THE PROPOSED HEUWELTJIES WEF

1.5.1 *Tadarida aegyptiaca:*

T. aegyptiaca, the Egyptian free-tailed bat, is known to forage over a wide variety of habitats in Southern Africa, with an approximate range of 1,340,000 km^2 (Eiting, 2020; Monadjem et al., 2020). Generally, this bat species flies effortlessly above the vegetation’s canopy and is found in agricultural fields, grassland, savanna, and semi-desert scrub, as well as in desert habitats (Monadjem et al., 2020). *T. aegyptiaca* consumes insects of the Lepidoptera and Hymenoptera orders, which are likely damaging pests (Eiting, 2020). However, this bat species tends to stay away from forest habitats (Monadjem et al., 2016). Within arid environments, the presence of *T. aegyptiaca* is to a large extent associated with permanent water bodies and/or standing water that attract concentrated densities of insects. *T. aegyptiaca* females give birth to a single pup annually.

In previous years, before the increase in wind farms, T. *aegyptiaca* was not perceived to be under threat (MacEwan et al., 2016), as it is widely distributed over Southern Africa. However, there is currently a serious cumulative threat from the proliferation of wind farms. 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 occurs, wind farms concentrated in certain biomes in South Africa could threaten a species or sub-species that has not been described yet. When all South African bat species are considered, preliminary data indicate that *T. aegyptiaca* experiences the highest fatality from wind farms and with the increase in these developments, one could expect that this trend will continue.

1.5.2 *Neoromicia capensis:*

When compared to other bats from Southern Africa, it is likely that *N. capensis* (the Cape Serotine bat, also known as the Cape Roof bat) has the most wide-ranging distribution, with an approximate range of 1,392,522 km^2 within Southern Africa (Monadjem et al., 2020; Monadjem et al., 2016). This bat species occurs in every part of the Southern African region (Monadjem et al., 2016). *N. capensis* seems to exploit a variety of environmental conditions, which include arid semi-desert localities, as well as montane grasslands, forests, savanna, and to a smaller extent, low-lying savanna. They also seem to forage at various altitudes, and even though they are seen as a clutter-edge forager, a great number of carcasses of this species have been collected at wind farms up to now.

The females of this bat species have their birthing period once a year, during which twins are frequently born, although a single pup, triplets, as well as quadruplets, have been documented in the past (Monadjem et al., 2020). Even though *N. capensis* currently has large population numbers, a continuous, gradual decline in population numbers in certain areas can be expected, based on the number of confirmed deaths from wind turbines at operational WEFs (Monadjem et al., 2020; Monadjem et al., 2016), as well as ignorance in dealing with bats in roofs.

N. capensis, with its clutter-edge foraging style, has a particular role to play in controlling insect populations that damage crops (Monadjem et al., 2016). Individuals of the species have been formally recorded hunting insects in groups, frequently gathering above water sources. This could be a particularly effective strategy in mosquito control.

1.5.3 *Sauromys petrophilus:*

S. petrophilus, Roberts' flat-headed bat, has an extensive, albeit patchy, distribution throughout Southern Africa (Monadjem et al., 2020; Jacobs et al., 2022). *S. petrophilus'* range expands towards the south into the Western Cape Province and towards the east along the northern border of South Africa.

S. petrophilus is closely associated with rocky habitats, which account for its uneven distribution within its range (Jacobs et al., 2022). These habitats are typically found in dry woodland areas within mountain fynbos, or localities with arid scrubs, such as the arid areas in the western part of southern Africa. *S. petrophilus* is largely confined to rocky regions, requiring narrow rock crevices, as well as fissures and exfoliating rock slabs (underneath which they roost) for roosting during the day, where they normally roost together in small groups of up to 10 bats (Monadjem et al., 2020).

2. ASSUMPTIONS AND LIMITATIONS

The following limitations apply to this study:

- Knowledge of various 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 knowledge of the impact of WEFs on such bat species also has limitations.
- 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, as the same individual could pass the detector more than once, does not provide total population estimates of how many individuals are present on site.
- 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 rather indicates activity, and 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) and weather conditions (low 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 through 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 make identification challenging. For this study, if the species of a recording is unidentifiable, the species identification of the recording were marked as 'unclear'. Recordings for which the species identification was 'unclear' were still included in the analyses.
- Transects only provide a snapshot in time and do not convey information about long-term 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 was not possible to search the entire study area as well as the wider terrain for bat roosts within the timeframes of the study. However, the project site was driven and walked through as thoroughly as possible, keeping in mind the time constraints of an environmental 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 variations cannot be accurately inferred from this data, and as such, bat activity in the future could vary substantially from the results presented here.

3. TECHNICAL DESCRIPTION

3.1 PROJECT LOCATION

The site for the proposed Heuweltjies WEF is located on the Remainder of the Farm Witpoortje No.16 and Portion 8 of the Farm Klipgat No.114 in the Central Karoo in the Prince Albert Municipality, in the Western Cape, see Figure 5. The site lies to the east of the N12 national road, approximately 75 km south of the town of Beaufort West and 55 km east of Prince Albert, as the crow flies (33º01'40.00" S; 22º35'40.05" E – Google Maps, 2022). The Swartberg Mountain Range lies to the south of Heuweltjies Farm and the Nuweveldberge is located to the north.

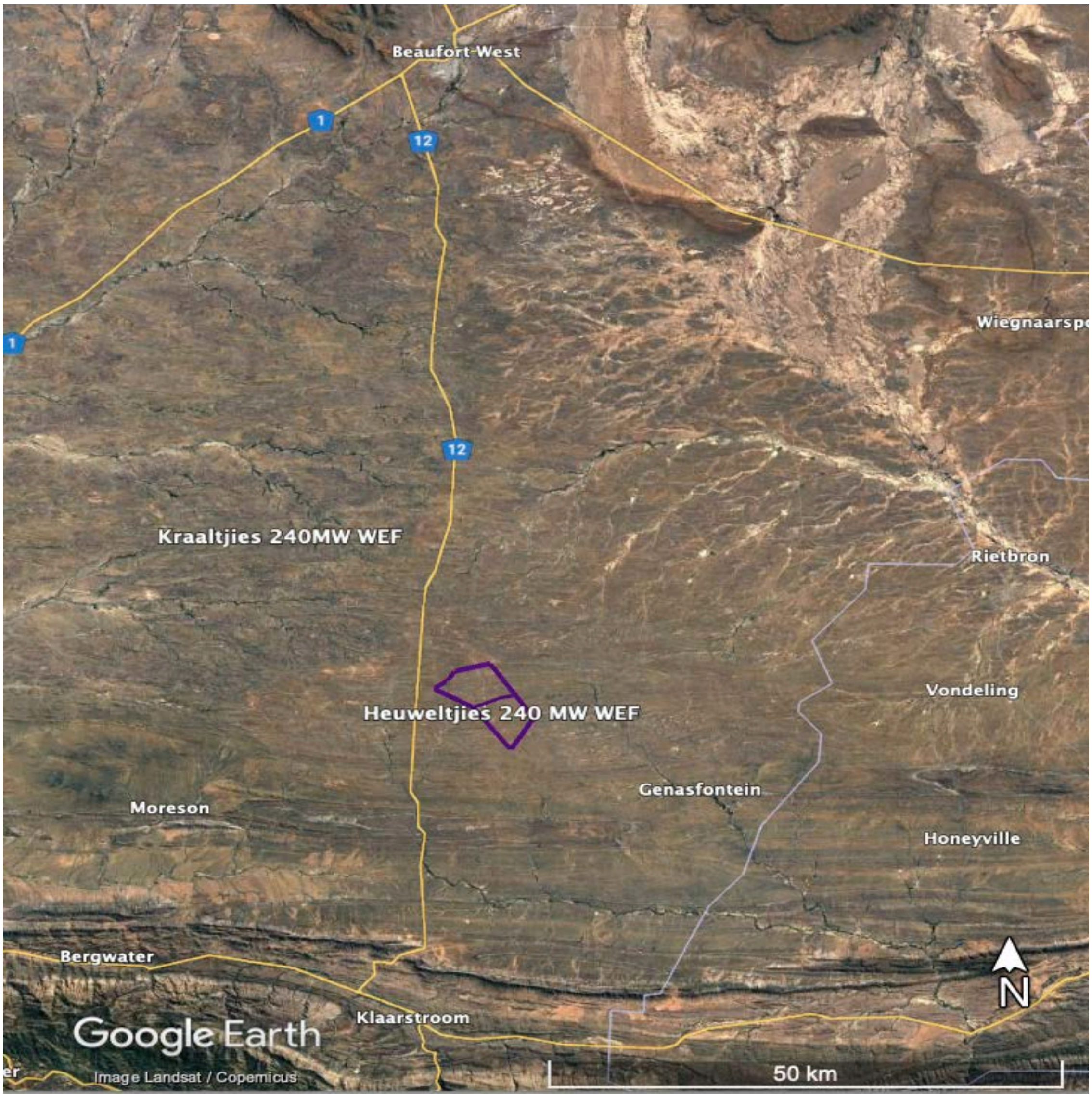


Figure 5: Locality map for the proposed Heuweltjies 240 MW WEF (Google Earth)

3.2 PROJECT DESCRIPTION

The proposed Heuweltjies WEF will have a maximum export capacity of up to 240 MW. The following is proposed for the development, also indicated in Figure 6:

- Up to 38 turbines;
- Turbines up to 200 m hub in height;
- Turbines up to 200 m in rotor diameter;
- Road servitude of 8 m;
- One new 11kV - 33/132kV on-site substation (including IPP & Eskom portions);
- A Battery Energy Storage System (BESS);
- One construction laydown/staging area of up to approximately 3 ha, to be located on the site identified for the substation; and
- Operation and Maintenance (O&M) buildings.

Grid connection infrastructure will consist of an overhead power line up to 132 kV and a 33 kV/132 kV project on-site substation. The BESS, IPP and Eskom portion of the on-site substation will cover a surface area of up to 25 ha. The 132 kV grid connection and Eskom switchyard portion will form part of a separate Basic Assessment (BA) process and are therefore not included in this WEF and associated infrastructure EIA application. The bat assessment will focus to a large extent on the turbine layout as this is the aspect of the proposed project that impacts bats specifically.

The proposed development is informed by 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).

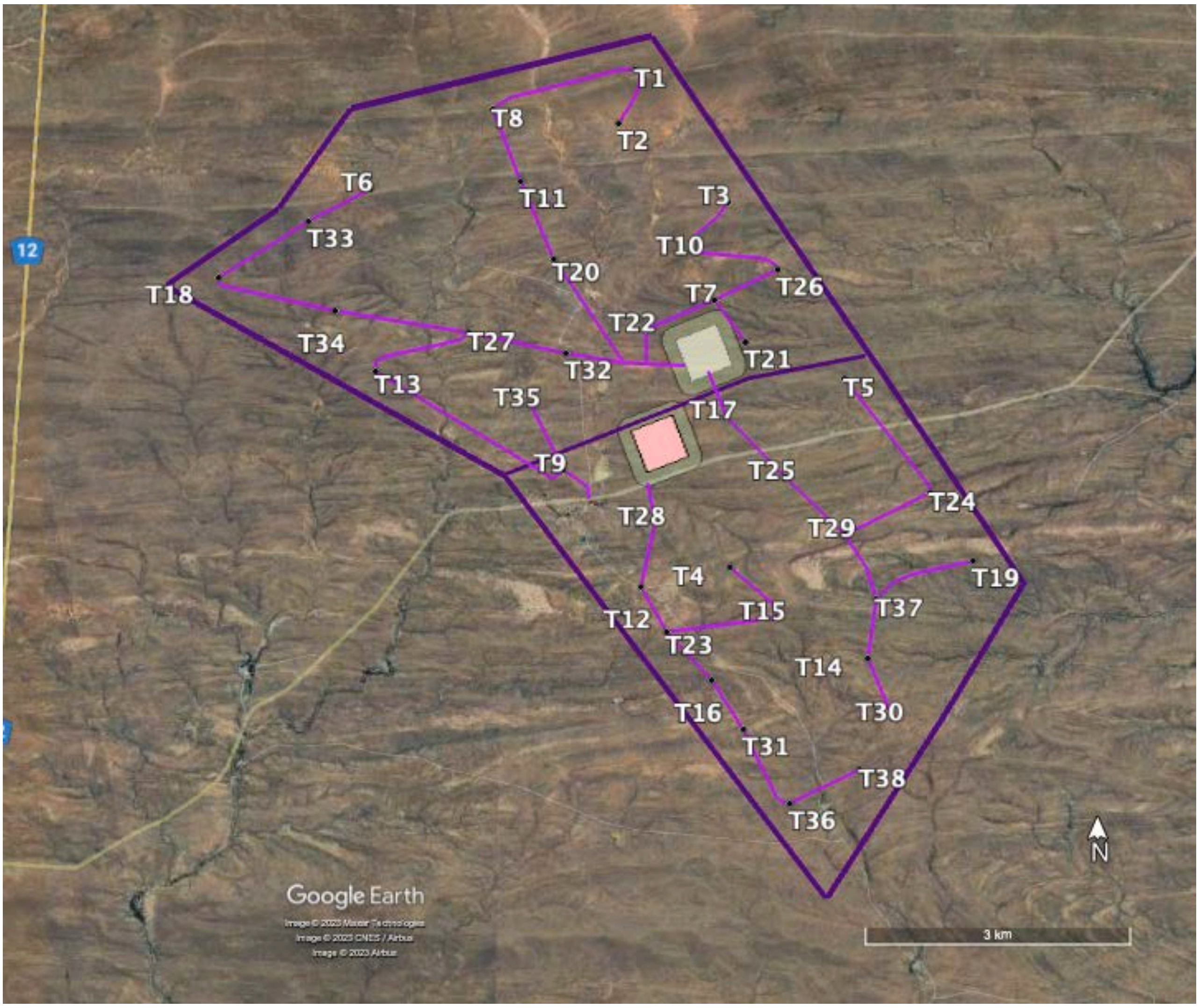


Figure 6: The proposed Heuweltjies 240 MW WEF, showing the proposed turbine layout, and supporting infrastructure

3.2.1 'No-go' Alternative

The 'no-go' alternative is the option of not undertaking the proposed WEF and 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 REQUIREMENTS AND GUIDELINES

Environmental law in the form of legislation, policies, regulations, and guidelines guide and manage development practices 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. 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); and
- 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); and
- Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson *et al*., 2020).

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 REGIONAL VEGETATION AND CLIMATE

5.1.1 Climate

Weather details are provided for Prince Albert, which is situated approximately 50 km from the site. (https://weatherspark.com/y/87787/Average-Weather-in-Prince-Albert-South-Africa-Year-Round, 2022 and https://www.meteoblue.com/en/weather/maps/prince-albert_south-africa_964078#coords=3.48/-35.22/21.9&map=temperature~daily-max~auto~2%20m%20above%20gnd~none).

The summers in the area are hot and the winters cold, with average temperatures varying from 4 °C to 29 °C; see Figure 7. The hottest months of the year are January and February, while the coldest months of the year are June and July. While it is mostly dry and clear year-round, rain can fall throughout the year. The highest rainfall on average is around 22 mm in April, with the lowest average rainfall of 7 mm in September (Meteoblue, 2021). Humidity levels are consistently low throughout the year. The highest windspeeds are experienced from September to March, with average wind speeds of more than 13 km/hour. The windiest month of the year is December, with an average hourly wind speed of 15 km/hour.

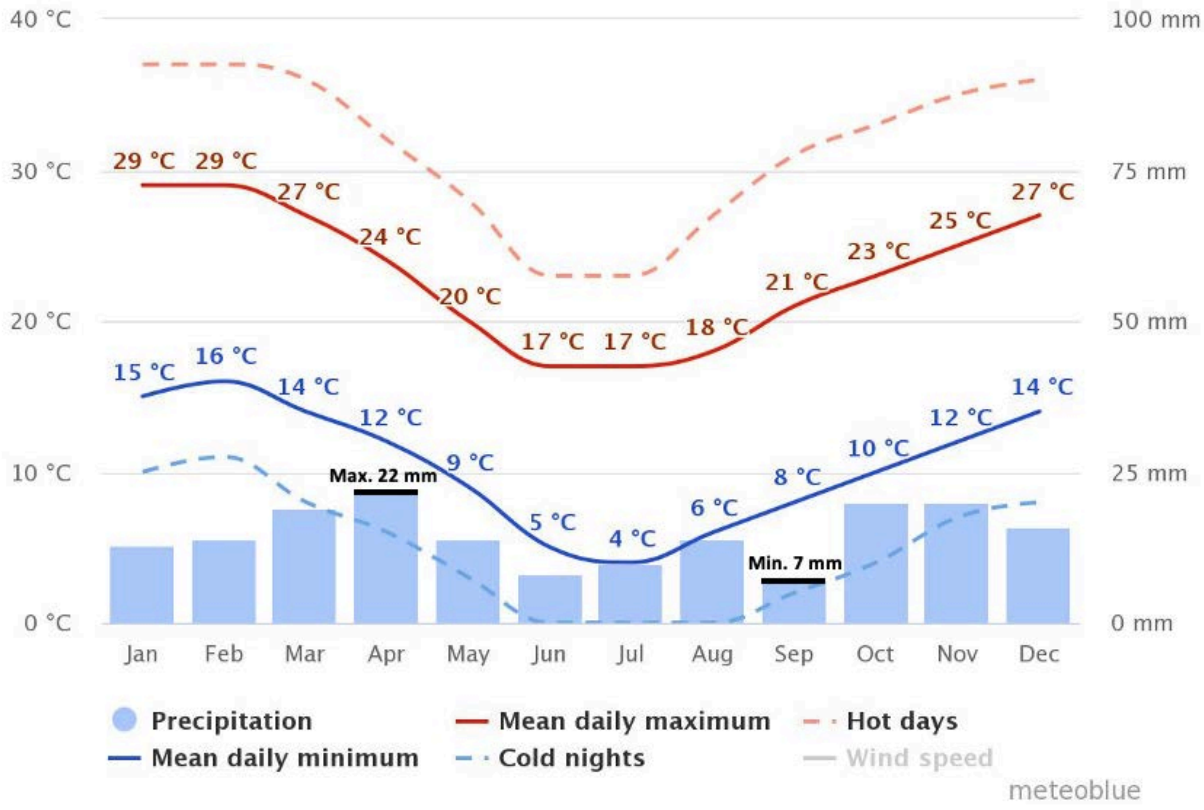


Figure 7: Climate of Prince Albert (Modified after Meteoblue, 2021)

5.1.2 Vegetation

The proposed development falls within the Nama Karoo Biome and regionally within the Lower Karoo Bioregion, with Gamka Karoo being the single dominant vegetation type found within the study area (Figure 8) (SANBI, 2012). The Gamka Karoo vegetation unit occurs mainly in the Western and Eastern Cape Provinces, between the Great Escarpment (Nuweveld Mountains) in the north and the Cape Fold Belt mountains, specifically the Swartberg Mountains, in the south. The landscape is comprised of slightly undulating plains, covered with dwarf spinescent shrubland and low trees in the river beds. Following good rains, drought-resistant grasses may dominate in the sandy basins. Being located in the rain shadow of the Cape Fold Belt, the Gamka Karoo is considered as one of the most arid units of the Nama Karoo Biome. Although only 2% of this vegetation type is formally conserved in the Karoo National Park, very little is transformed and is therefore considered Least Threatened (Mucina & Rutherford, 2006).

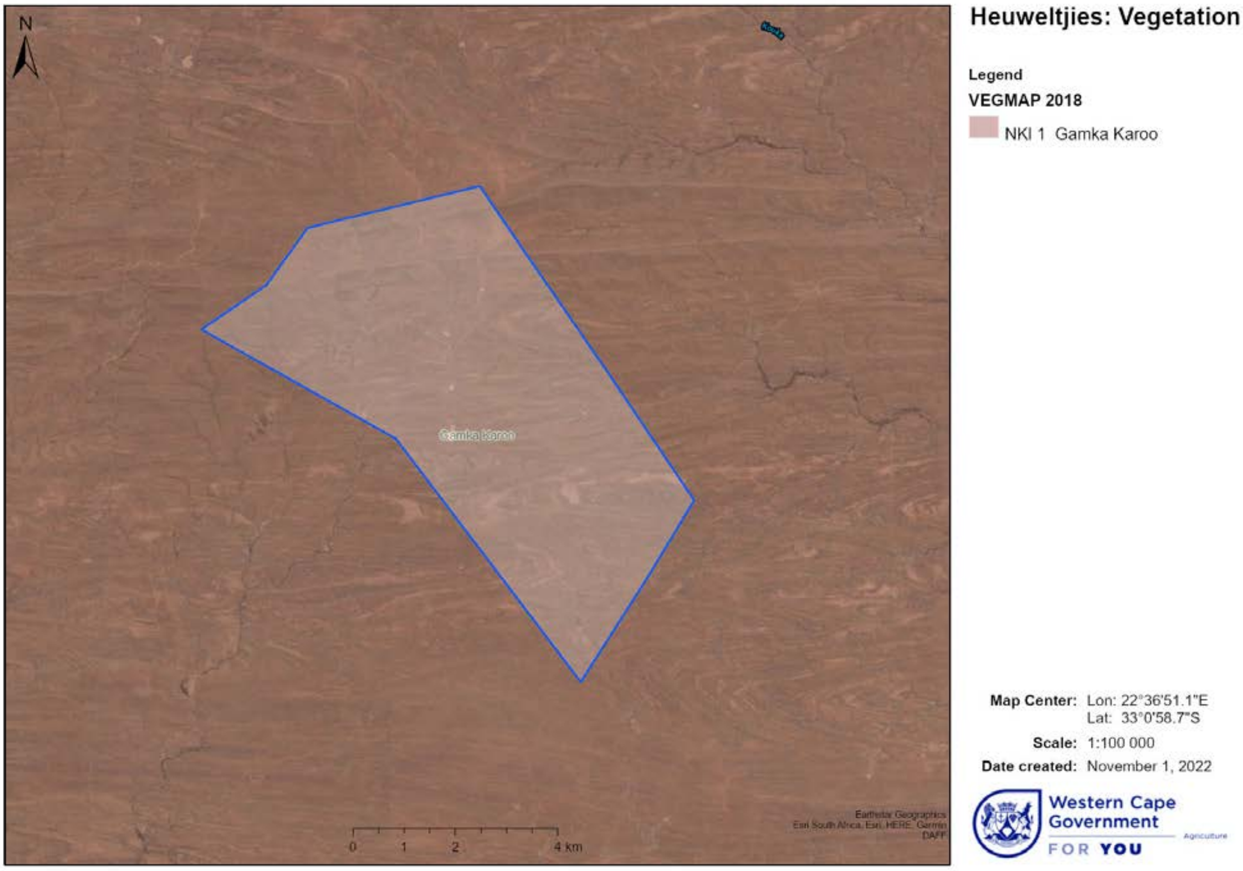


Figure 8: Vegetation Zones on the proposed Heuweltjies 240 MW WEF site (WCG 2021)

5.1.3 Protected Areas

Although not situated close to any formal protected areas, various protected areas are located towards the south of the site, close to the Swartberg mountains; see Figure 9. As the crow flies, the Henry Kruger Private Reserve, the nearest registered reserve, is situated approximately 45 km, to the northwest and the Karoo National Park is situated less than 50 km to the north. The proposed power line runs through the Steenbokkie Private Nature Reserve, located a few kilometres east of Beaufort West, and northeast of the proposed WEF.

The latter has no formal conservation status and comprises mainly a guest farm offering tourist accommodation, game viewing, hiking, hunting and mountain biking. There is a Critical Biodiversity Area (CBA) to the west of the proposed Heuweltjies up to 240 MW WEF site, but no CBAs on the actual WEF site.

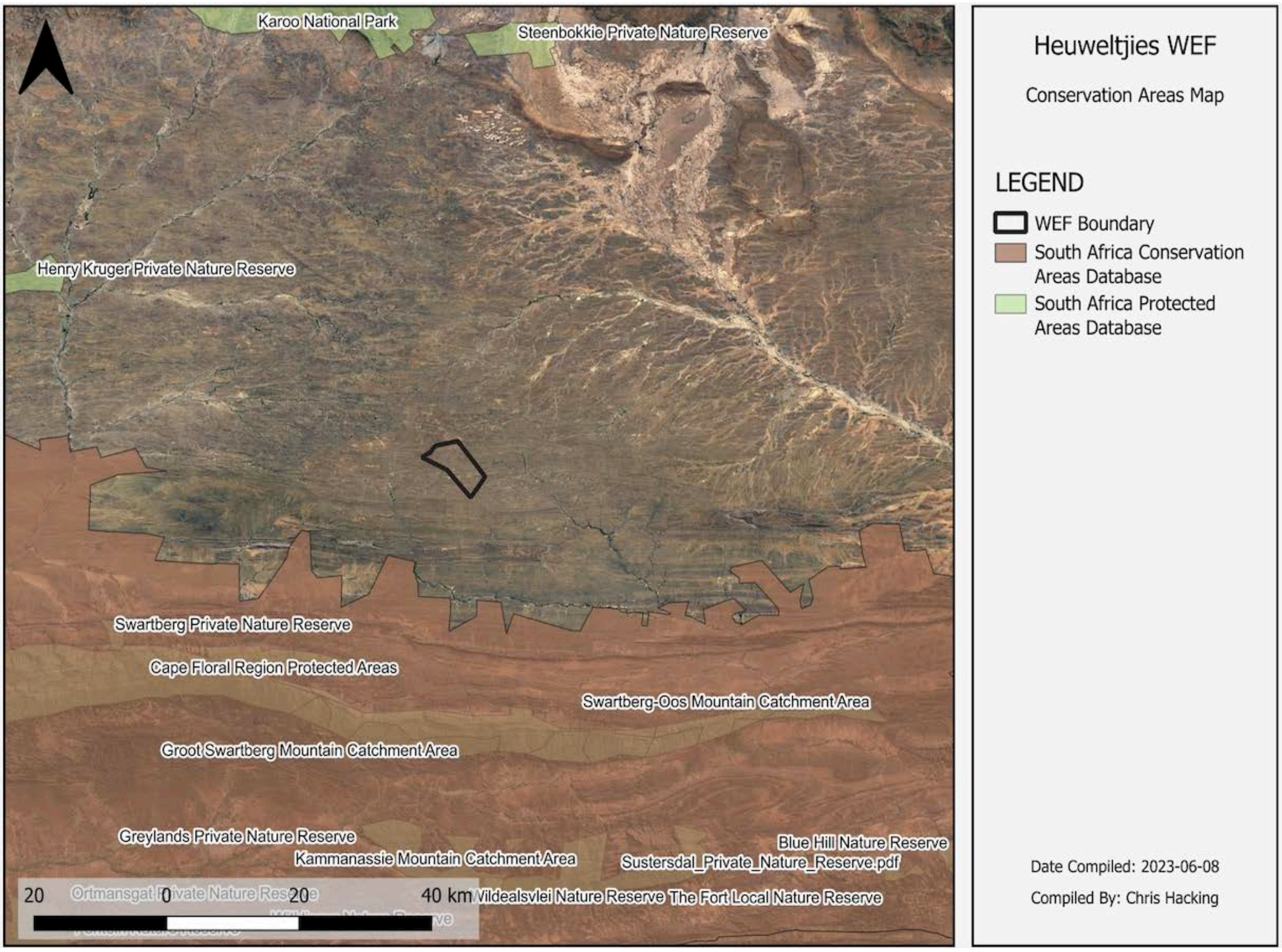


Figure 9: Protected areas and conservation areas in the vicinity of the proposed Heuweltjies WEF

5.1.4 *Land use*

Because of the low average annual rainfall, the carrying capacity in the Heuweltjies area is also low, resulting in large farm units; see Figure 10. The soil on site is bluish-coloured shallow shale. This fine-grained sedimentary rock supports an extremely thinly dispersed and stunted vegetation. Angora goats and sheep are the most common livestock in the area as the vegetation can only sustain small livestock numbers. Many of the farmers now concentrate on game (https://www.karoo-southafrica.com/koup/; 2019). The towns in the areas are spread-out and the area supports large, dispersed farm units.

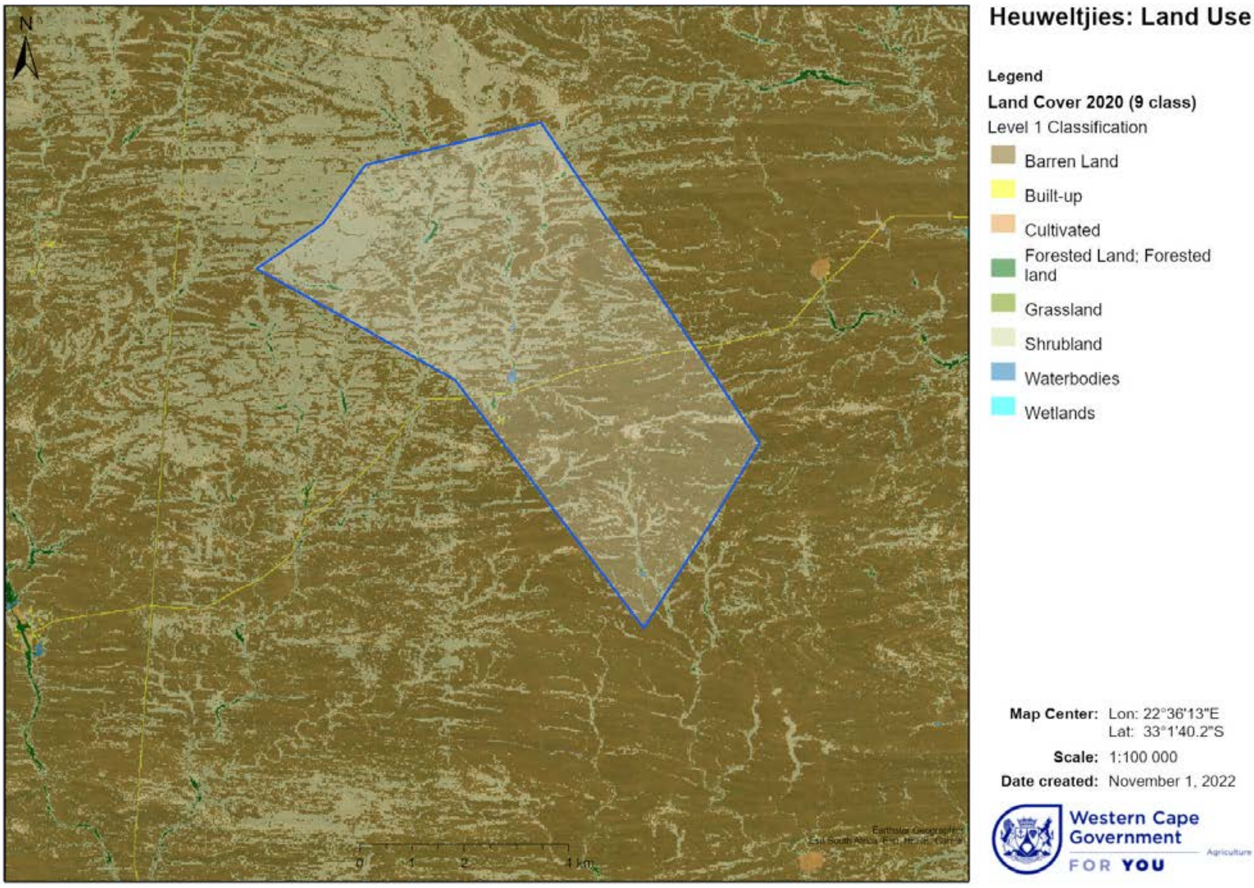


Figure 10: Land use in the proposed Heuweltjies WEF area

5.1.5 Water resources

Although there are no permanent waterbodies on the development terrain, there are numerous dry water courses and non-perennial water bodies; see Figure 11. During rainy spells, water collects in these non-perennial ditches, depressions, and farms dams. Not only could these temporary open water sources provide water to drink to bats, but stagnant water could be a breeding ground for insects, which in its turn attract bats.

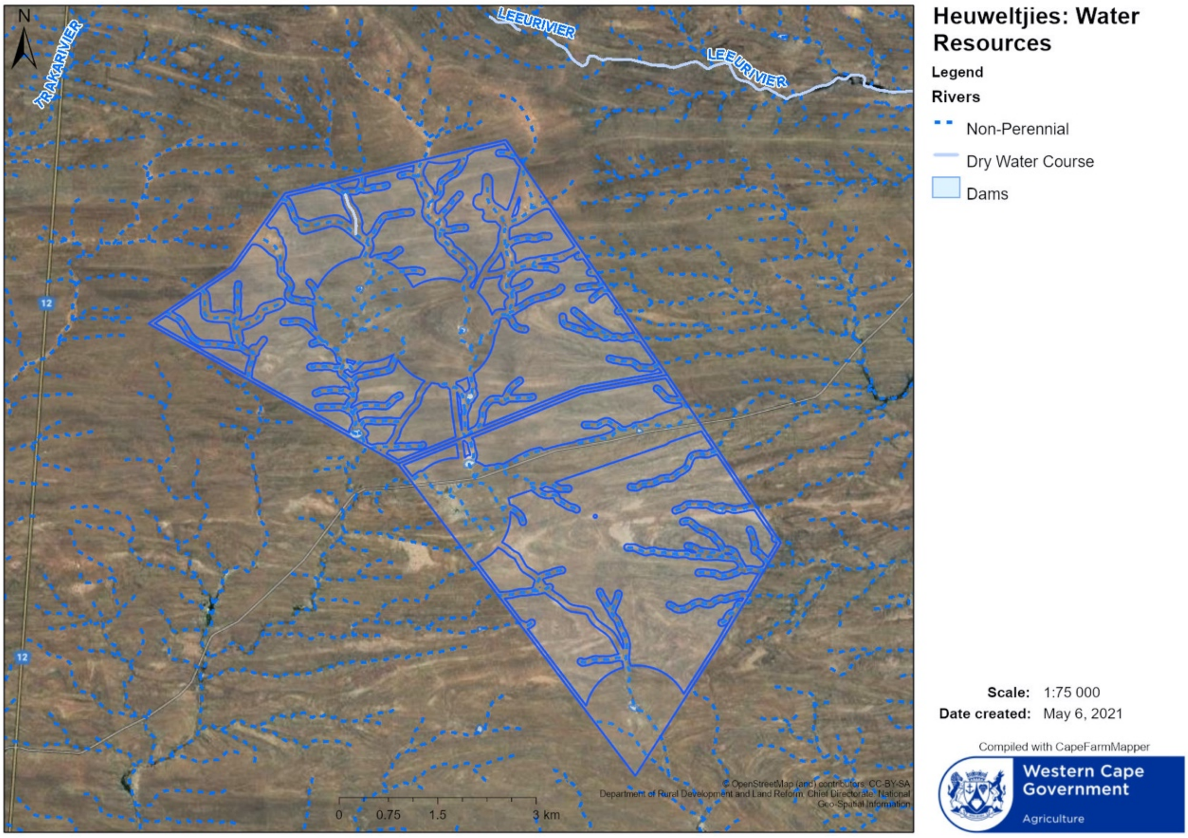


Figure 11: Waterbodies on the proposed Heuweltjies 240 MW WEF

5.2 FEATURES CONDUCIVE TO BATS AT THE PROPOSED 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.

5.2.1 Vegetation

Although most of the site is covered in Gamka Karoo vegetation typical of the area, trees situated in the dry riverbeds could provide roosting opportunity for bats that prefer roosting in vegetation or under the bark of trees; see Figure 12.

Figure 12: Relatively dense vegetation along the dry riverbeds

5.2.2 *Rock formations and rock faces*

Rocky outcrops and rock formations along the ridge lines and along river valleys could provide roosting opportunities for bats.

5.2.3 *Human dwellings*

Existing buildings, especially where roofs are not sealed, or uninhibited, derelict buildings (Figure 13) could provide roosting opportunities. Although bat roosts have not been found at the proposed Heuweltjies WEF to date, bat roosts are regularly found in buildings in similar environments with limited roosting opportunities. Roost searches will be ongoing and will continue in the operational phase.

Figure 13: Derelict buildings at the proposed Heuweltjies 240 MW WEF

5.2.4 *Open water sources*

Water troughs for the livestock and associated open cement reservoirs also provide permanent, open water sources for bats right throughout the year; see Figure 14. A large farm dam can be seen in the picture below.

Figure 14: Open water sources at the proposed Heuweltjies WEF

5.2.5 *Food sources*

High insect activity results in higher bat presence after sporadic rainy periods. Livestock also attracts flies, which in turn could serve as a food source for bats.

5.3 BACKGROUND TO BATS IN THE AREA

The extent to which bats may be affected by the proposed wind farm will depend on the extent to which the proposed development area is 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 identified in Table 2 have distribution ranges that include the proposed Heuweltjies WEF development site and bat presence confirmed on the site itself, or other wind farms in the area, are marked as such. The proposed WEF is located within the distribution range of six families and approximately 12 species. **Error! Reference source not found.** is informed by the most recent distribution maps of Monadjem, et al. (2010 and 2020). The information in Table 2 will be updated as required, based on the outcomes of the monitoring programme.

Of the 12 species with distribution ranges that include the proposed development area, four have a conservation status of Near Threatened and one Vulnerable in South Africa, while three have a global conservation status of Near Threatened. *Eptesicus hottentotus* (the Long-tailed serotine), *Cistugo seabrae* (the Angolan wing-gland bat) and *Rhinolophus capensis* (Cape horseshoe bat) are endemic to Southern Africa and have limited suitable habitat left, mainly due to agricultural activities (Monadjem, et al., 2020).

According to the likelihood of fatality risk, as indicated by the latest pre-construction guidelines (MacEwan, 2020) four species, namely *Miniopterus natalensis* (Natal long-fingered bat), *T. aegyptiaca* (Egyptian free-tailed), *S. petrophilus* (Roberts's flat-headed bat) and *N. capensis* (Cape serotine) have a high risk of fatality. The high risk of fatality for *T. aegyptiaca* and *S. petrophilus* is due to their foraging habitat at high altitudes, while *N. capensis*, though known as a clutter-edge forager, tends to forage at various altitudes, including within the sweep of turbine blades. *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 proposed Heuweltjies WEF development, as this environment is not expected to be their preferred habitat; however, they could traverse over the project site during migration and are therefore included.

Table 2: Potential bat species occurrence at the proposed Heuweltjies WEF site. Highlighted yellow cells indicate confirmed presence at the development site. Information about the species is from Monadjem, et al. 2010 and 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	
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Least Concern	Least Concern	Roofs of houses, caves, rock crevices, under exfoliating	Open-air, insectivorous	Not known	High	✓

Family	Species	Common Name	SA conservation status	Global conservation status (IUCN)	Roosting habitat	Functional group (type of forager)	Migratory behaviour	Likelihood of fatality risk*	Bats confirmed in vicinity
					rocks, hollow trees				
	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 (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	
VESPERTILIO-NIDAE	*Neoromicia capensis (now Laephotis capensis)*	Cape serotine	Least Concern	Least Concern	Roofs of houses, under bark of trees, at basis of aloes	Clutter-edge, insectivorous	Not known	High	✓
	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	

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
	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 T. aegyptiaca will be split into more than one species in the nearby future, but for the purpose of this study we conclude with the species as mentioned in the above table.*

6. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

6.1 STATIC RECORDERS

Passive monitoring data for the period between 15 August 2021 and 12 November 2022 are included in this 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 site. The results of this monitoring exercise, in terms of bat species identified and the number of bat passes identified from static recordings, are sufficient for EIA purposes. They are by no means an exact identification or indication of the number of bats present, but rather an indication of bat activity on site. True bat identification can only be made by specialist bat biologists when the bat or the bat carcass is physically available. Some of these identified species will be confirmed during the carcass searches in the operational phase.

Data gaps occurred at Systems J and M, due to microphone breakdowns. Although the ideal would be to have more comprehensive data from the system at 98 m (System J), the 52 m microphone (System K) was also situated within the prospective sweep of the turbine blades and there are enough data from both systems to make an informed decision for EIA purposes. The monitoring period and gaps in data are shown below in Table 3.

Table 3: Availability of data collected from the monitoring systems

Available Data	Gaps
15 Aug 2021 - 15 Oct 2021	None
15 Oct 2021 - 23 Apr 2022	100m Met High (J): 22 Oct 2021 - 23 Apr 2022 10m Mast (M): 26 Feb 2022 - 23 Apr 2022
24 Apr 2022 - 23 Sept 2022	100m Met High (J): 24 Apr 2022 - 26 Jul 2022
24 Sept 2022 - 11 Nov 2022	None

The 98 m and the 52 m monitoring stations (Systems J and K respectively) are the most important systems for this study due to their placement within the rotor-swept area of the turbine blades. Data from these systems, depending on the situation of the weather monitors, are compared with weather data to assess the weather's influence on the bat activity recorded within the sweep of the turbine blades.

6.1.1 Bat Species Diversity

Calls like of five of the 12 species that have distribution maps overlaying the proposed development site were recorded by the static bat monitoring detetors during the 12-month monitoring period (see Table 2 and Figure 15).

The data from the static recordings confirm the species distribution maps of the region. 76% of the calls of all the combined systems represent *T. aegyptiaca*, which is the dominant species on site. *T. aegyptiaca* is a high-risk species, physiologically adapted with a narrow wingspan to fly high, in the vicinity of the turbine blades.

Due to this foraging preference, the risk of collision and barotrauma is high. Two more high-risk species have a significant presence: *N. capensis* (16%) and *Sauromys petrophilus* (8%). The Near Threatened *Miniopterus natalensis* and the endemic *E. hottentotus* were also recorded, but not in statistically significant numbers. Note that 0% indicates statistical insignificance; therefore, low numbers of these bats were recorded, but they are recognised as part of the species diversity.

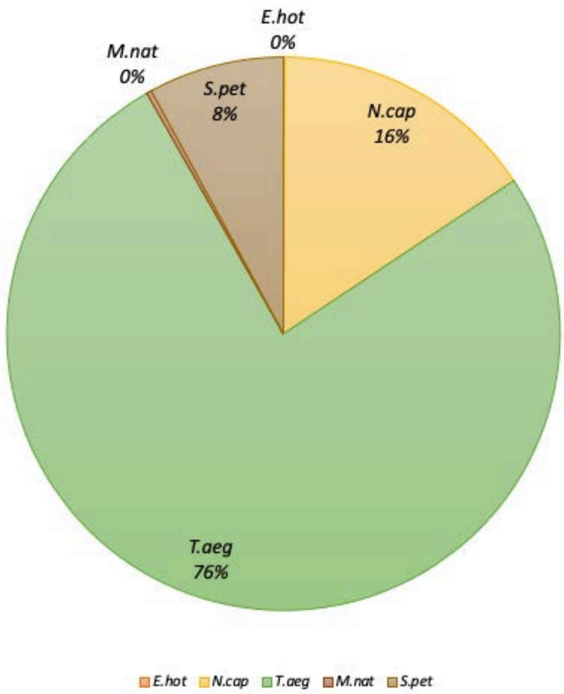


Figure 15: Bat species present at the proposed Heuweltjies WEF

Species diversity is often higher at lower altitudes, which is demonstrated in Figure 16. Although *T. aegyptiaca* is the dominant species recorded at all systems, at both lower and higher altitudes, it shows slightly higher activity at the higher systems: 98 m Met High (J) and 52 m Met (K). *S. petro*philus is the only statistically significant other species recorded at the two higher systems, with 11% activity at System J (98 m Met High) and 12% at System K (52 m Met). The Molossidae family is more dominant at the high-altitude systems at the proposed Heuweltjies WEF site, with the molossids *S. petro*philus and *T. aegyptiaca* statistically comprising 100% of all the activity recorded at height (Systems J and K). 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.

Both lower Systems L and M (8 m Met Low and the 10 m mast, respectively) recorded activity from *N. capensis,* with System M recording a significantly higher level of activity for this species, namely 33% of its total activity. *M. natalensis* and *E. hottentotus* were also recorded at the lower stations, but not in statistically significant numbers.

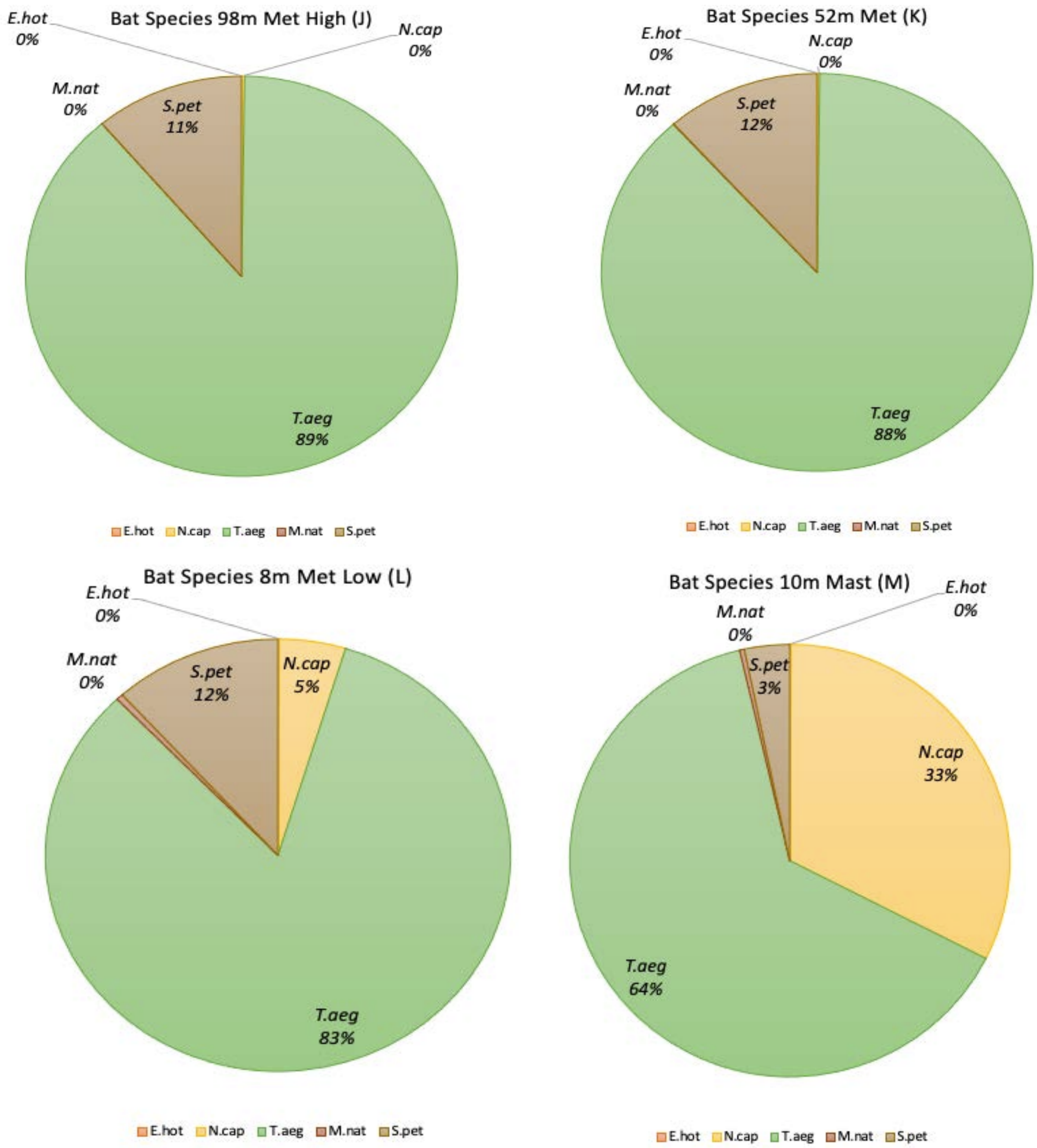


Figure 16: Species diversity at different altitudes for the proposed Heuweltjies WEF, as indicated by static recorders

6.1.2 *The activity of different species*

Figure 17 depicts the nightly medium for the species recorded on site over the entire monitoring period. As mentioned in the previous section, relatively high activity can be observed for *T. aegyptiaca*, followed by *N. capensis* and *S. petrophilus* respectively. Low activity from *M. natalensis* and *E. hottentotus* was recorded.

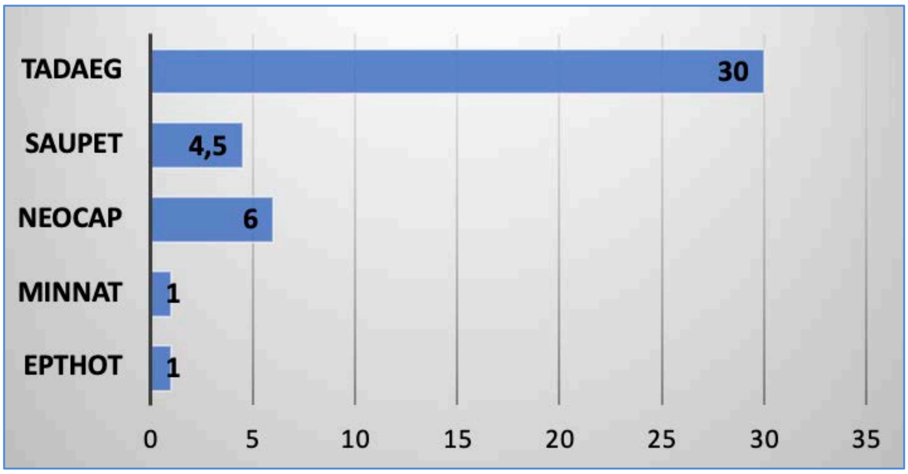


Figure 17: Nightly median of recorded species over the monitoring period

6.1.3 Species distribution over the monitoring period

Figure 18 below indicates the temporal distribution of bat passes over the monitoring period. The light blue histogram depicts higher activity, indicating the higher occurrence of *T. aegyptiaca*, especially during the mid-summer months of 2021-2022 (December 2021 to February 2022), with additional peaks in activity occurring in October 2022 (highest recorded activity for this species occurred here). *T. aegyptiaca* is the most consistently recorded species during the entire monitoring period, whereas a species such as *N. capensis* shows more variability in activity, peaking first at the end of December 2021, again at the end of February 2022 and finally again at the end of April 2022. This most likely indicates that bats stock up before the cold winter months set in. Also of note is the peak in February for this species, when the highest activity of all the species across the whole monitoring period was recorded. *S. petro*philus is also depicted, and while its activity remains consistently low, there is a slight increase between December 2021 and March 2022 during the summer months.

Figure 19 depicts the monthly average hourly bat passes within the sweep of the turbine blades. This demonstrates, as with Figure 18, the steady increase in bat activity from the month of September 2021 to March 2022, with a decrease in activity as autumn sets in and low activity during the winter months. Activity resumes again as spring arrives, with a peak occurring in September. Activity during September 2022 is clearly higher when compared to September 2021. Overall, bats tend to be more active when warmer months set in, especially if they have to increase food intake during pup season. There is often an increase in activity before winter, when they need to stock up for the colder winter months. This is shown in March 2022, and to a lesser extent in April 2022.

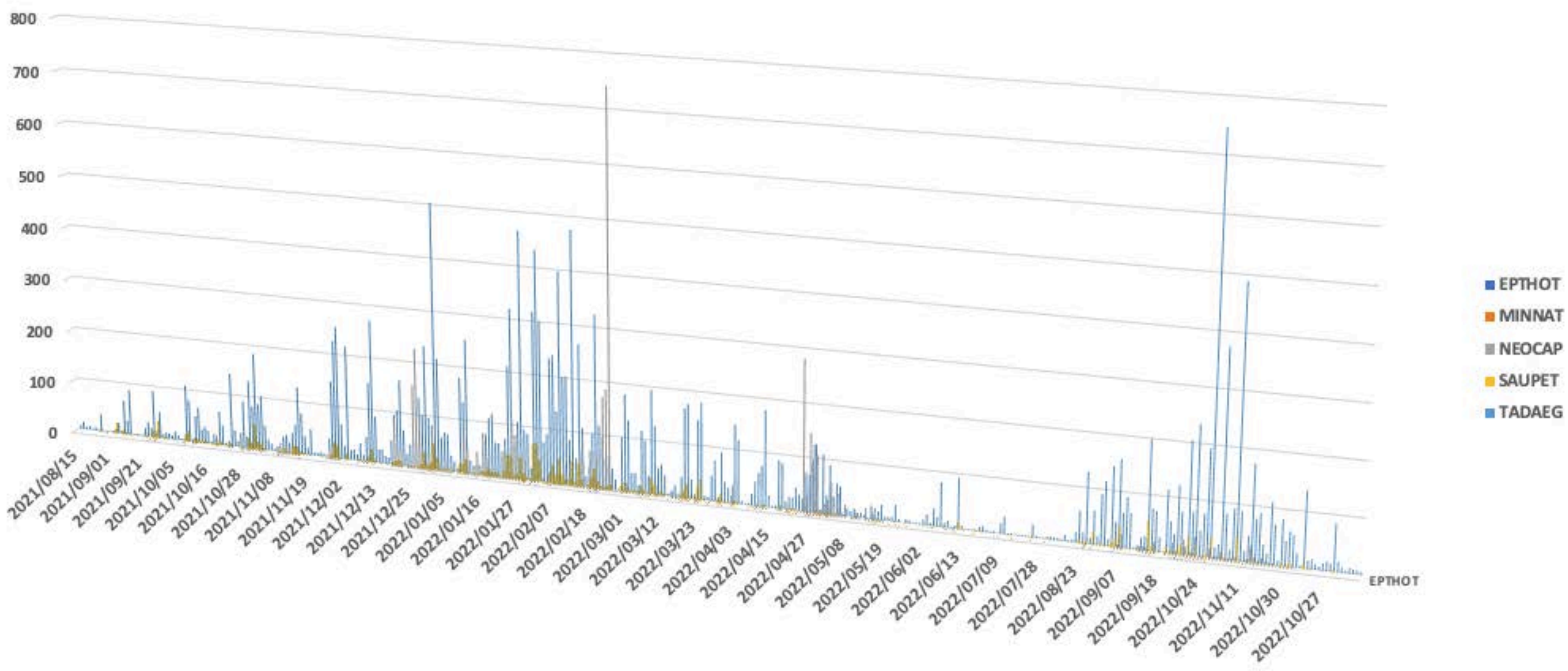


Figure 18: Distribution of bat activity over the monitoring period

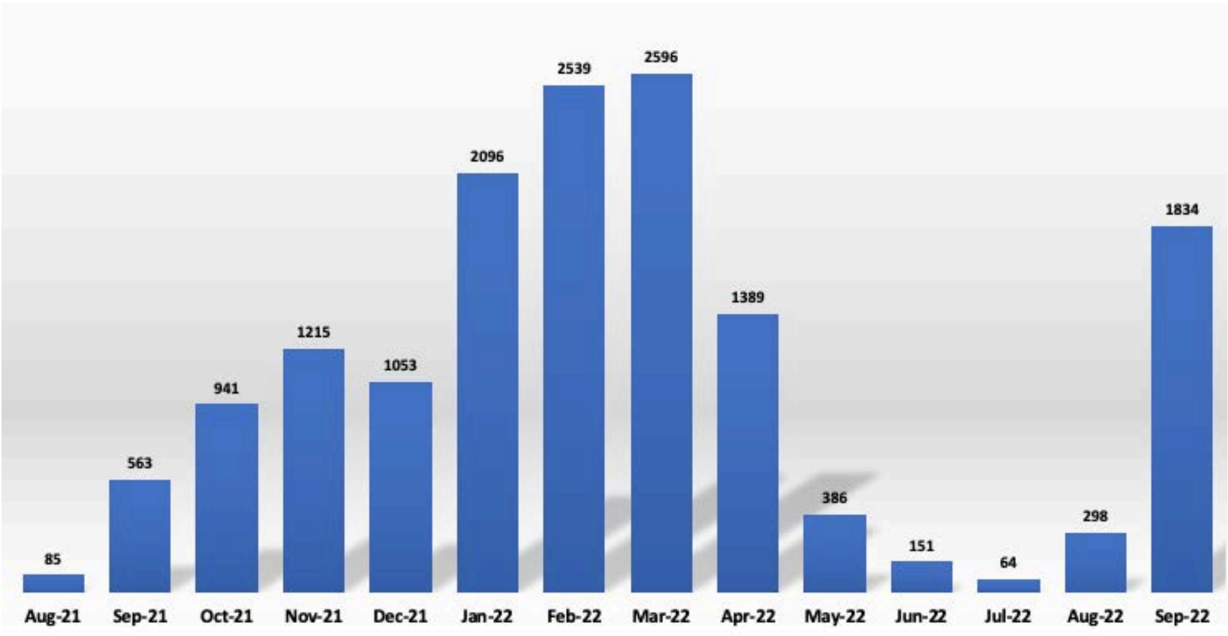
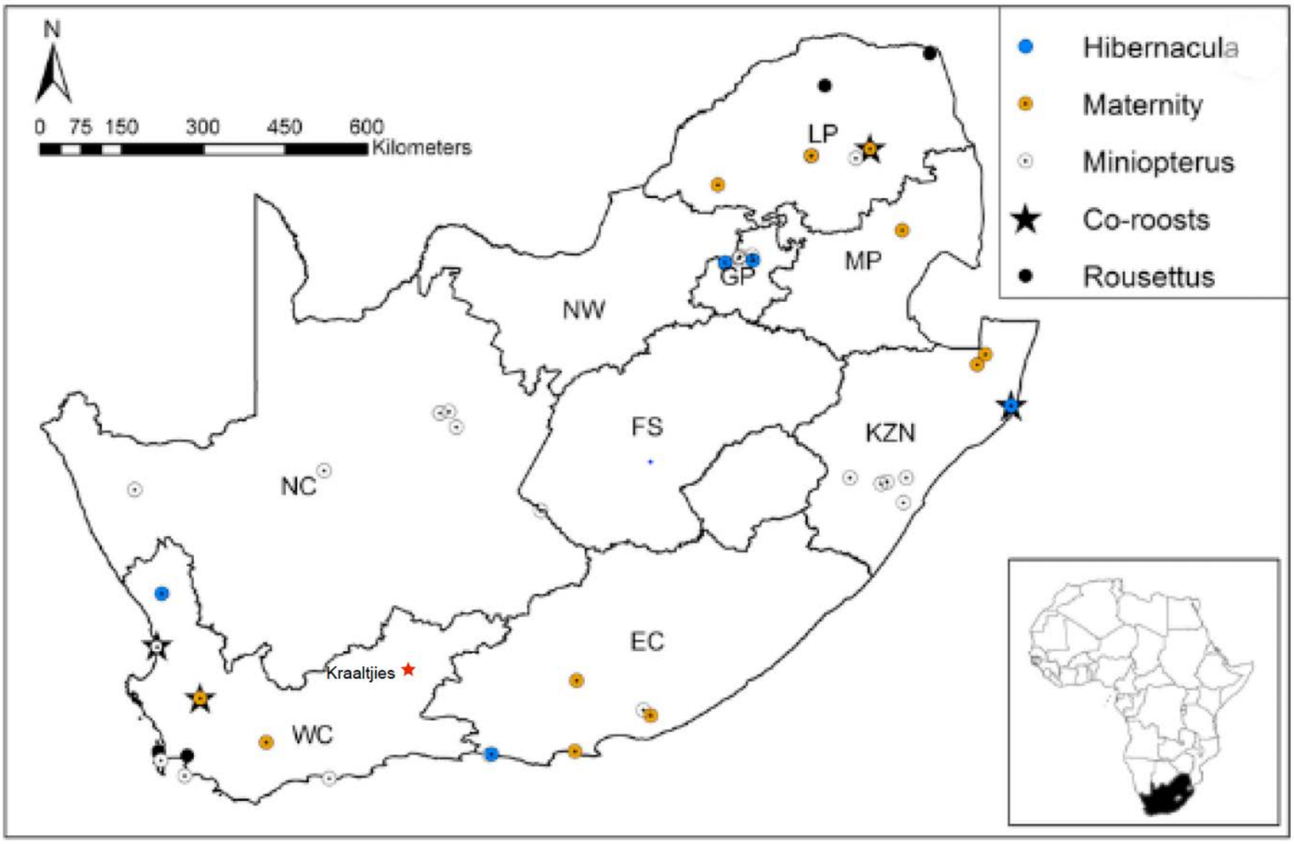


Figure 19: Monthly bat passes for the proposed Heuweltjies WEF

Figure 20 below depicts the average bat activity per season. It demonstrates proportionally higher activity in the summer months, while spring and autumn have very similar levels of activity, with spring having slightly more. Winter shows low levels of activity.

Figure 20: Seasonal proportions of activity

Figure 21 indicates roosts of *M. natalensis* and *Rousettus aegyptiacus*. Records show *M. natalensis* could migrate up to 150 km between caves. Although the overall relative activity of the migrating, Near Threatened *M. natalenis* was low, a sudden peak is observed during February 2022, with lower peaks showing in December 2021 and April 2022, see Figure 18. This could be pockets of bats traversing the site. The April peak could be a small pocket of bats migrating over the site, as this species tend to migrate during the autumn months. Similar, higher activity pockets of this species had been recorded at the nearby Kraaltjies WEF detectors during bat monitoring. At both sites, *M. natalensis* was mostly recorded by the lower systems, but depending on the lowest point of the turbine blades, which could be between 14,5 m and 20 m from the surface, these bats could be at risk by the lower sweep of the turbines.



Roosts for Miniopterus natalensis (open circles) and Rousettus aegyptiacus (black circles) throughout South Africa. Important sites (maternity and wintering roosts) for Miniopterus natalensis are indicated in yellow and blue respectively. Locations where both species roost together are indicated by black stars (Co-roosts)

Figure 21: *Miniopterus natalensis* roosts in South Africa (Pretorius, et al, 2021)

Several potential cave structures and derelict mines occur within a 100 km radius of the proposed Heuweltjies WEF, especially towards the south in the Swartberg mountain range; see Figure 22. Dolerite deposits in these mountainous areas tend to support cave structures. Although these structures are not necessarily the size and grandeur of the Cango caves, smaller structures might house *M. natalensis*, which is a cave-dwelling bat. This is especially significant when considering the high activity recorded during the bat monitoring at the proposed closeby Kraaltjies WEF, and the possibility of roosts of *M. natalensis* situated beyond the borders of the wind farm. The bat specialist during the operational phase should be vigilant for high activity of this species during post-construction monitoring, based on the limited knowledge of migration patterns of bats in South Africa, and acknowledging the precautionary principle of environmental assessment.

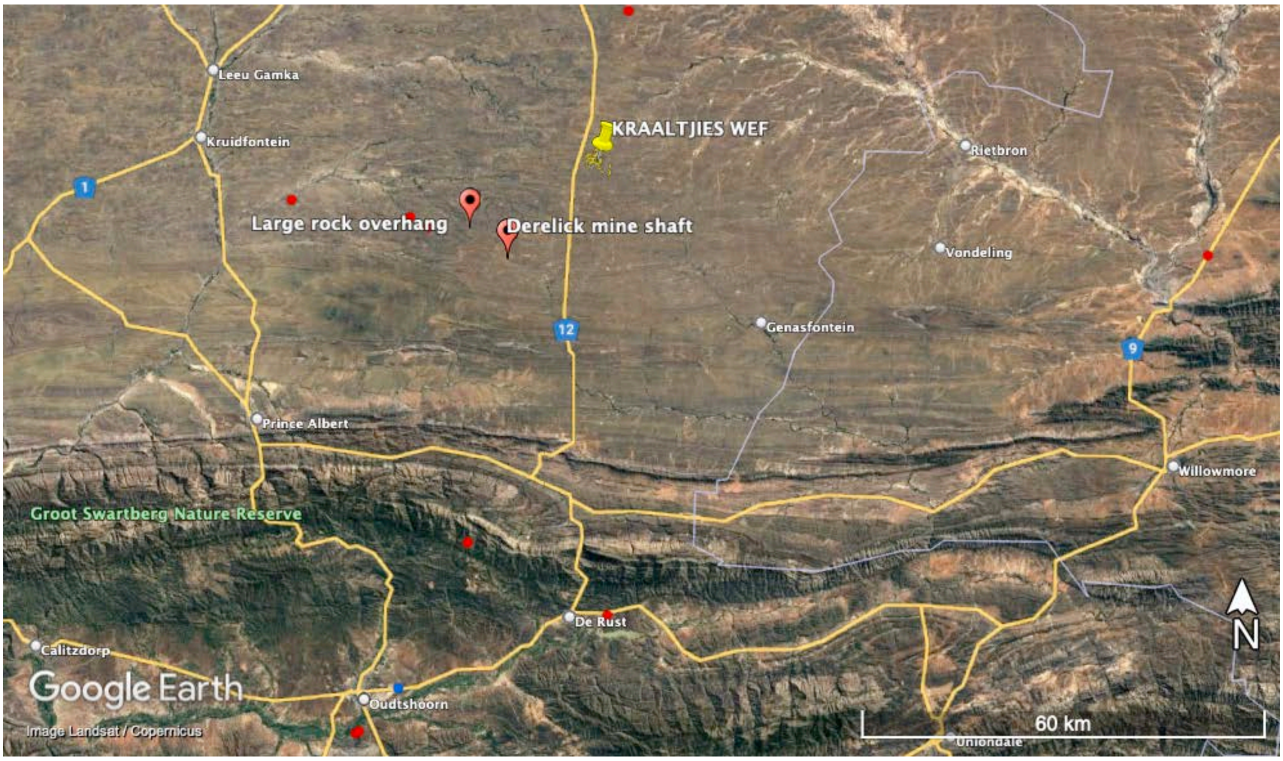


Figure 22: Red dots indicate all the derelict mines identified in the area around the proposed Heuweltjies WEF

6.1.4 Bat activity per monitoring station

Bat activity over the monitoring period at all four systems is depicted in Figure 23. This allows for a comparison of bat activity at different heights throughout the monitoring period. Despite the gaps in the data discussed in Section 6.1, it is evident that System J, the highest monitoring station at 98 m, demonstrates lower overall activity than the other three systems for the periods of data collection. This is in stark contrast to the other three lower monitoring stations, which all have their peak in bat activity in March (2022) for System K (52 m Met) and System L (8 m Met Low), or in February (2022) for System M (10 m Met Mast). This also highlights the fact that that not only is there a greater diversity of bat species at lower levels, but there is also higher activity at lower altitudes. All of the systems show a marked dip in activity in winter between May (2022) and August (2022). The second highest System K (52 m Met) has the most consistently high bat activity over the monitoring period, compared to the highest and the lower systems, which tend to have more extreme variability in bat activity. System M (10 m Met Mast) had the highest peak in activity in February 2022, with nearly four times as much activity as all the other stations.

Figure 24 below depicts bat activity of each species present over the monitoring period, showing the activity at each monitoring system. The most abundant species, *T. aegyptiaca,* is the most recorded species at all monitoring stations, with its highest levels of activity recorded at System M (10 m Mast). *S. petrophilus* is the second most consistently recorded species, which was most active at System L (8 m Met Low). *N. capensis* demonstrates minimal activity, except at System M (10 m Mast).

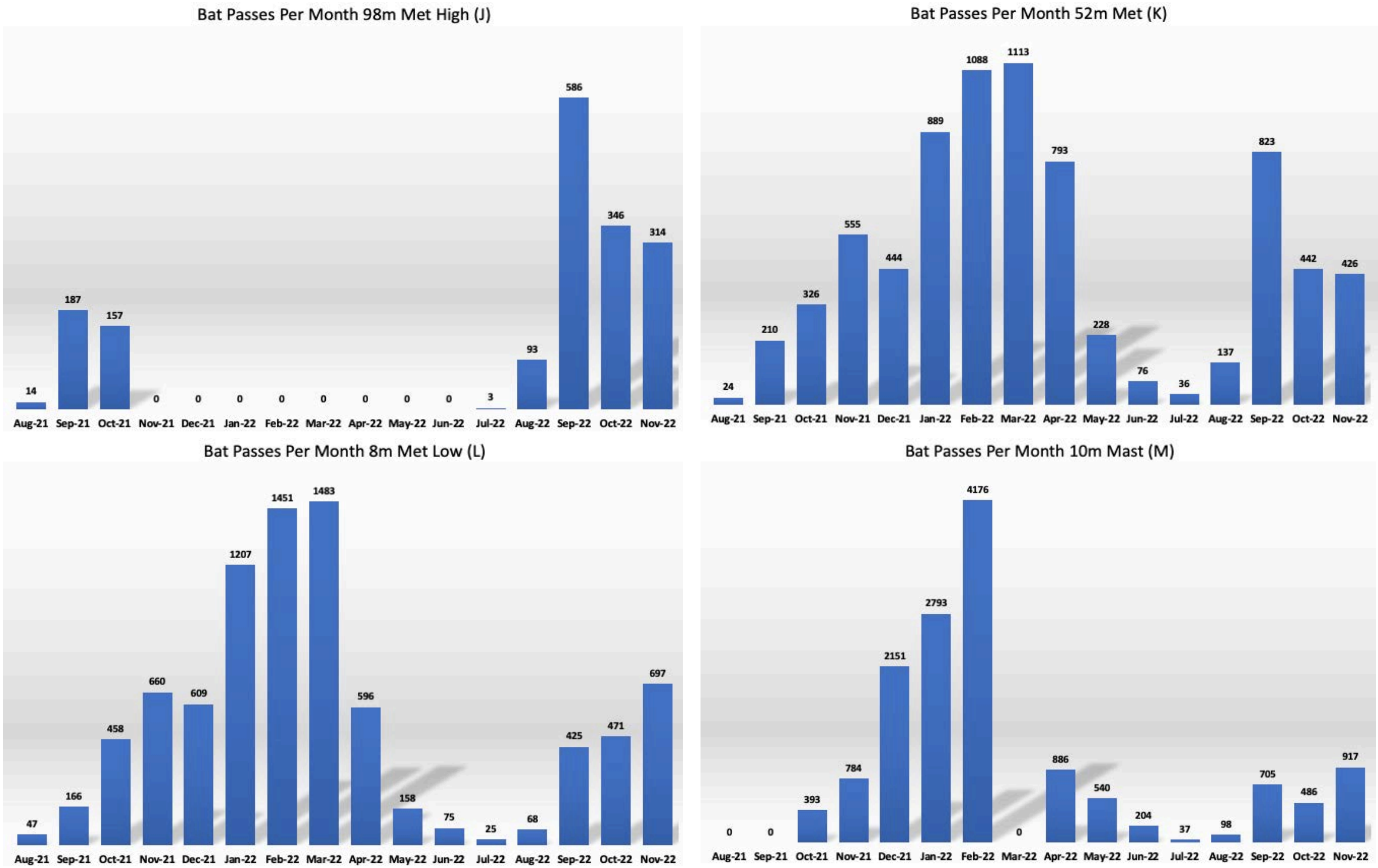


Figure 23: Total bat activity for each monitoring station during the monitoring period

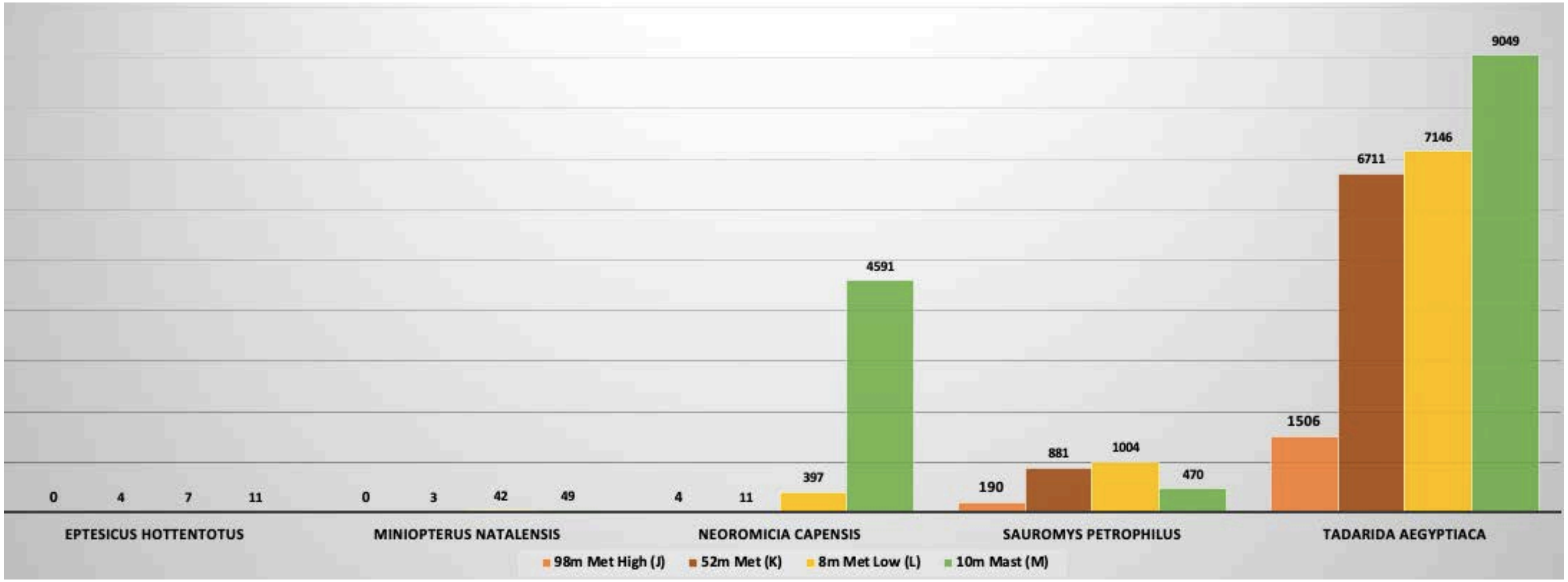


Figure 24: Combined species activity per monitoring station during the monitoring period

6.1.5 *Nightly distribution of bat activity*

Bat activity distribution during nighttime is portrayed in Figure 25 below. These patterns are of importance if mitigation measures are to be developed, as they indicate the most active periods during the night. This figure provides insight into the general distribution of bat activity within the project site for each night, from sunset to sunrise. This represents an accumulation of various seasons and it must be noted that sunset and sunrise times shift with seasons. If curtailment is necessary for the site, it is suggested that the most recent activity data for the particular season is used, together with the data below, to refine the curtailment schedule.

In general, all the monitoring systems show a steady increase in activity after sunset, when bats emerge to drink and forage. After midnight a decline in activity follows, until three to four hours before sunrise, after which there is minimal activity as sunrise approaches.

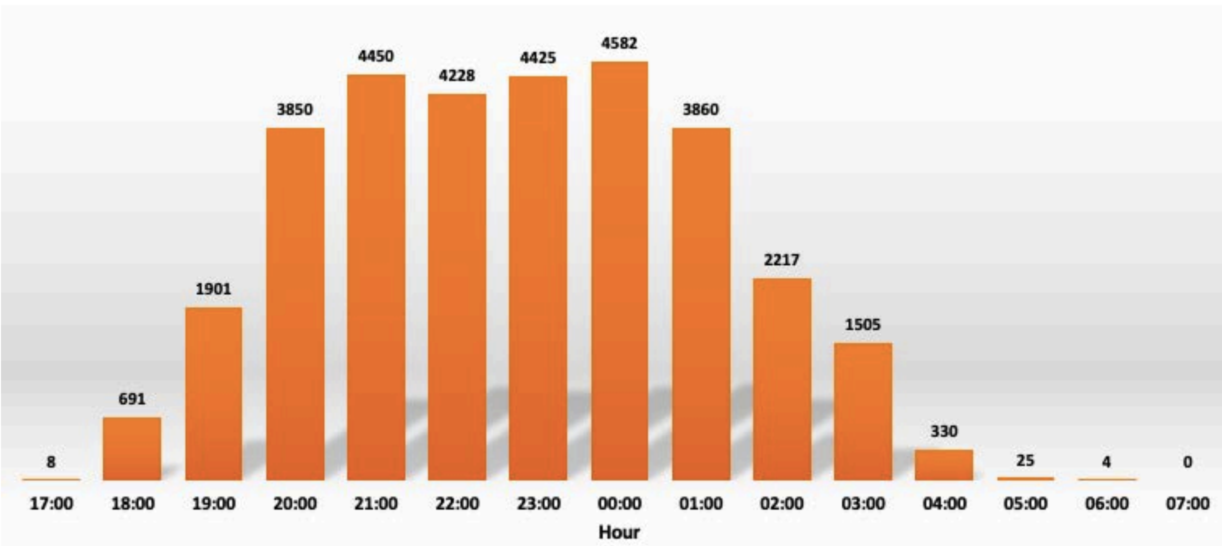


Figure 25: Nightly bat activity distribution

Figure 26 below provides further detail on the hourly activity recorded at each monitoring system during the course of a night. All the monitoring systems demonstrate a gradual increase in bat activity between 18:00 and 21:00; activity then plateaus, before declining between 23:00 and 0:00. Minimal activity is recorded at all of the stations after 4:00. It is evident that the lower monitoring Systems M and L (10 m and 8 m Met Low respectively) have a higher overall record of activity throughout the night, particularly System M. This system differs the most when compared to the higheer monitoring Systems , which recorded lower activity (keeping in mind the data gaps) throughout the night, with activity remaining very constant, and peaking very early in the evening at 20:00. System M (10 m Mast) also peaked somewhat early, at 21:00, in comparison to System L (8 m Met Low) and System K (52 m Met) which peaked later at 23:00.

Figure 26: The hourly bat activity for each monitoring station during the span of a night

6.2 BAT THRESHOLD

The South African Bat Fatality Threshold (MacEwan et al., 2018) and the South African 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 impacts on bat fatalities posed by WEFs. These biomes and ecoregions are identified by diverse biodiversity patterns determined by climate, vegetation, geology, and landforms (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.

Table 4 below indicates the height-specific bat activity and fatality risk according to the South African pre-construction bat guidelines (MacEwan et al., 2020), together with the median of hourly bat activity at height over the proposed Heuweltjies WEF monitoring period, from Systems K, at 52 m and System J, at 98 m, and near ground level, from Systems L and M, between 8 m and 10 m respectively. The combined median bat activity per hour at near-ground level is 0,85, while the combined median bat activity per hour within the rotor sweep area is 0,42, both of which are categorised as medium risk. According to the bat threshold guidelines, at this level, some fatality minimisation measures should be recommended during pre-construction where greater than medium or high risk levels occur, which should be applied from the commencement of turbine rotation. Although activity levels from the rotor sweep systems at the Heuweltjies site falls within the medium rusk level, it is on the border (0,42) of the high risk category. Extra care should therefore be taken with bat data collection during the operational phase, and the developer should prepare for possible turbine specific fatality mitigation.

Table 4: The bat fatality risk threshold for Nama 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)
Nama Karoo	Near ground	<0,18	0,18 – 1,01	>1,01
	Rotor sweep	<0,03	0,03 – 0,42	>0,42
Height of monitoring systems at the proposed Heuweltjies WEF site			**Median of hourly bat activity for the monitoring period**	
Combined activity from 10 m systems (L, M) near ground.			0,85	
Combined activity from 52 m (K) and 98 m (J) in the rotor sweep area.			0,42	

*Near-ground = 3 to 11 m above ground level, Rotor sweep = 50 to 110 m above ground level.

6.3 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. Lower monitoring systems follow the same pattern to a large extent. However, as weather monitoring systems 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 against the weather data. These data could be used to compile a mitigation schedule for sensitive areas to be implemented from the onset of the operation of the WEF. Weather conditions, especially temperature, wind, humidity and barometric pressure, could have an influence on bat activity. Literature (Baerwald, *et al*. 2008, 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 phases.

Weather data from the Met mast were utilised for the statistical analyses below. Weather correlations were conducted with System J and K (situated respectively at 98 m and 52 m), as these systems were situated closest to the weather collection points and also within the area of collision risk. These data were then used to inform the curtailment measures that may be needed during the operational phase. The near ground data will not inform the mitigation measures, as the only available weather data is from the Met mast, and the samples were taken far from the low bat monitoring sampling point. See Appendix 1 for weather distribution graphs wherein the number of nights was plotted over wind speed, temperature, humidity and barometric pressure. The following weather data from the Met mast were used for correlations:

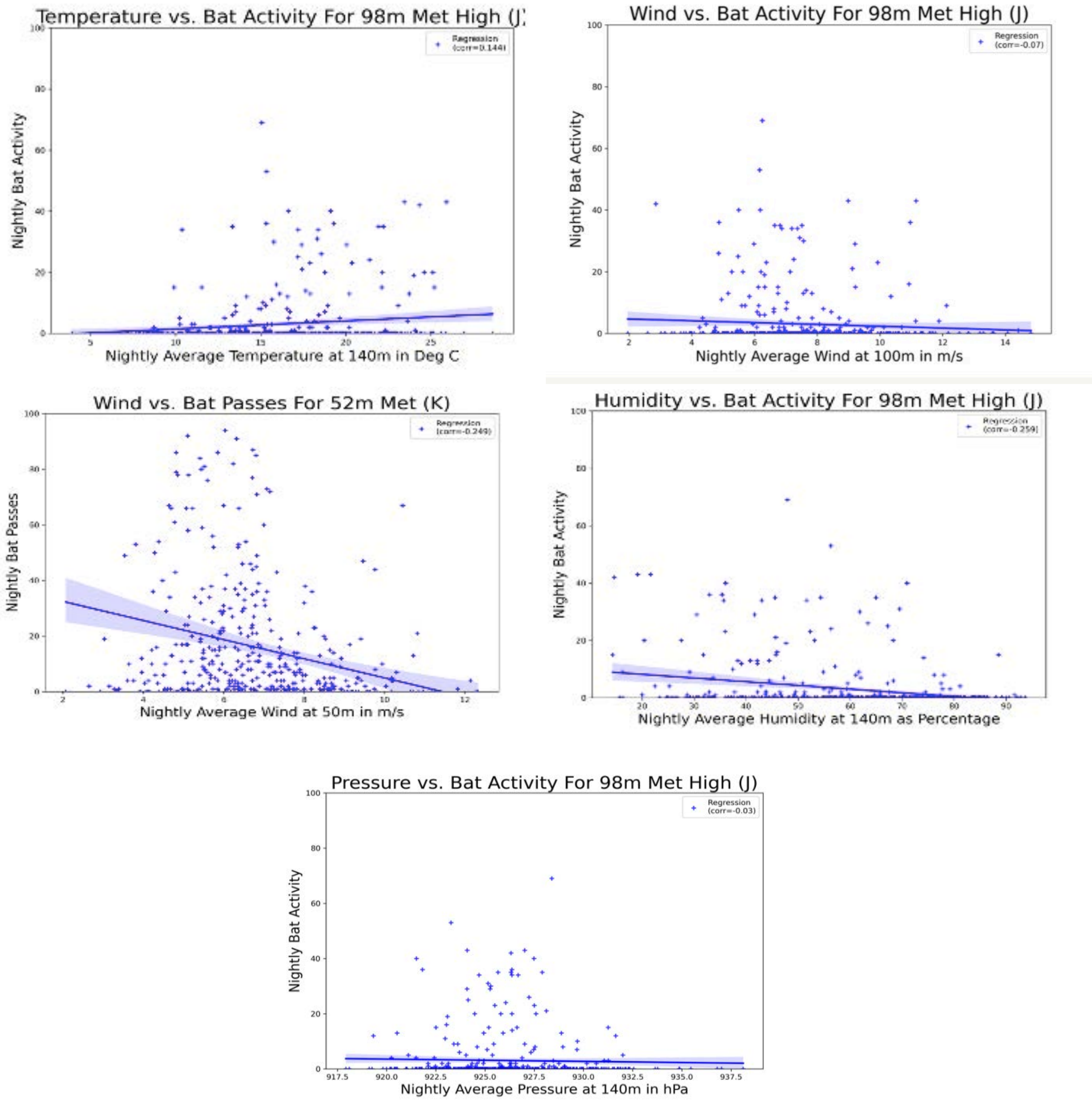
- Temperature data from 140 m;
- Wind data from 50 m and 140 m;
- Humidity data from 140 m, and
- Pressure data from 140 m.

6.3.1 Linear Regression

Results of a linear regression between weather conditions and bat activity are provided in Table 5 below. There is a small sample size of bat data from all the monitoring systems for 12 months. Furthermore, bats are not necessarily active during various weather conditions. The linear regressions could therefore sometimes result in inadequate variation. They nevertheless provide an indication of the positive or negative relationship between weather conditions and bat activity. As more data becomes available during the post-construction period, linear regression analyses should be applied to the data again.

Table 5: Summary of linear regression

	Correlation Coefficient	
Temperature and bat activity for System J (98 m Met High)	0.144	Weak positive relationship between temperature and bat activity. Bat activity increases as temperature increases.
Wind vs. and bat activity for System J (98 m Met High)	-0.07	Very weak negative relationship between wind speed and bat activity. As wind speed increases, bat activity decreases slightly.
Humidity and bat activity for System J (98 m Met High)	-0.259	Weak negative relationship between humidity and bat activity. As humidity increases, bat activity decreases.
Barometric pressure and bat activity for System J (98 m Met High)	-0.03	No statistical relationship between barometric pressure and bat activity.
Wind and bat activity for System K (52 m Met Middle)	-0.249	A weak negative relationship between wind and bat activity. As wind increases, bat activity decreases.



<u>Figure 27: Linear regression as predictors of the distribution of bat activity: Temperature, wind, humidity and pressure on the 98 m Met high (System J) and wind at 52 m on the Met middle (System K)</u>

6.3.2 *Cumulative distribution functions (CDF)*

Figure 28 below illustrates the cumulative distribution functions, where cumulative means an increased quantity by successive additions, wherein cumulative bat activity recorded is plotted with temperature, wind speed and humidity data. Barometric pressure was not used for further statistical analysis, as linear regressions in the previous section indicate that with the current data available no correlation exists between bat activity at Heuweltjies WEF and barometric pressure. The cumulative percentages indicate the following results:

- Nearly 100% of the bat activity was recorded above 10 °C.
- Approximately 90% of bat activity was recorded below 11 m/s wind speed at 98 m and approximately 90% of bat activity occurred below 8 m/s at 52 m.
- Nearly 90% of bat activity was recorded below 70% humidity.

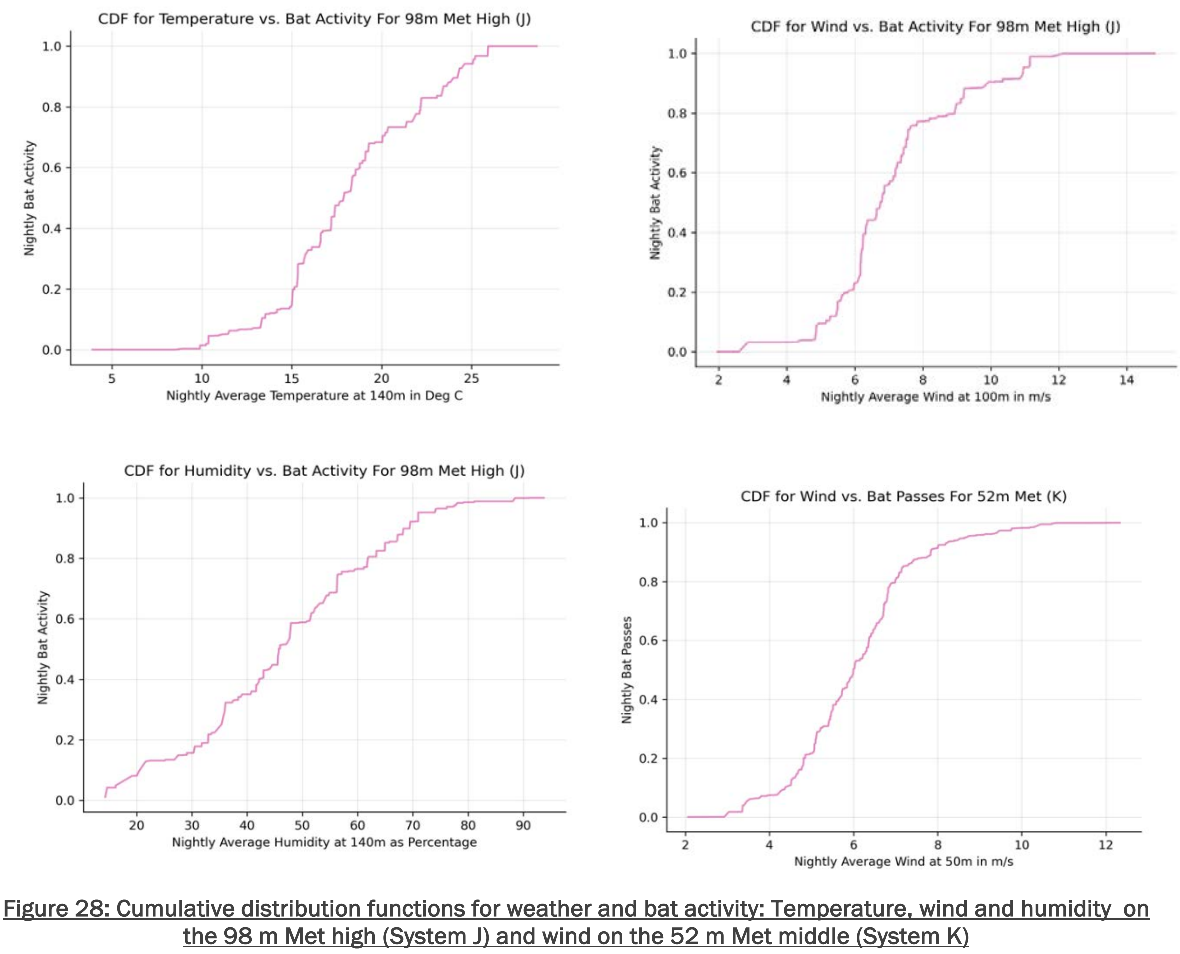
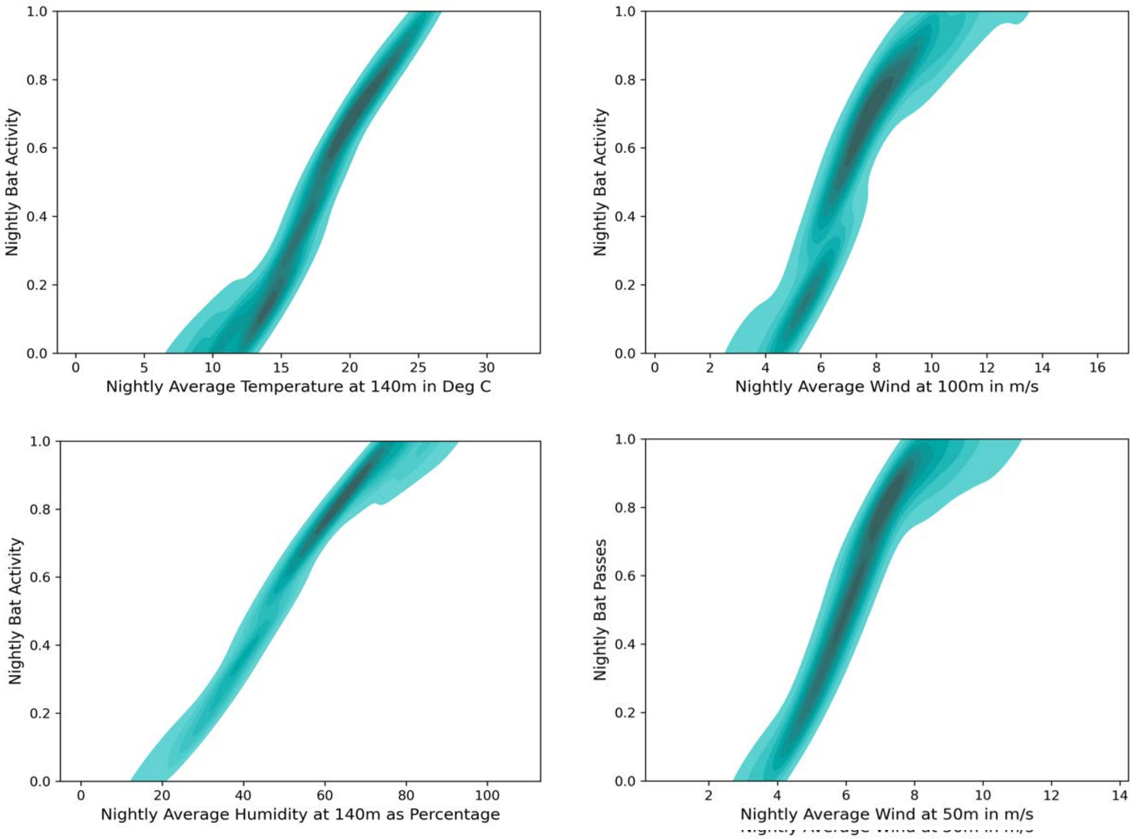


Figure 28: Cumulative distribution functions for weather and bat activity: Temperature, wind and humidity on the 98 m Met high (System J) and wind on the 52 m Met middle (System K)

6.3.3 Cumulative distribution function heat maps

CDF heat maps provide a better visualisation of the concentration of bat activity when plotted with weather conditions (see Figure 29) and confirm the results from the previous section (Section 6.1.9). Darker areas indicate a concentration of activity. The density of bat passes during certain temperatures, wind speed and humidity ranges for the 98 m Met High (J) and 52 m (K), for wind, can be clearly observed when CDF heat maps are plotted.



<u>**Figure 29: CDF heat maps showing weather and bat activity: Temperature, wind and humidity on the 98 m Met high mast (System J) and wind on the 52 m Met middle (System K)**</u>

The following could be derived from Figure 29:

- Nightly average activity and temperature: A concentration of bat activity occurred between 18.5 °C and 26 °C, but activity density is also observed at higher temperatures.
- Nightly average activity and wind speed: A concentration of bats occur below 8.75 m/s, with most bats being active at wind speeds below 11 m/s.
- Nightly average activity and humidity: Bat activity at the proposed Heuweltjies WEF shows pockets of concentration at levels above 40% humidity, between 40% and 70% humidity.

6.4 TRANSECTS

Transects are a snapshot in time but the data from this sampling confirm species present at the site. The transect route, with the stationary monitoring points, is depicted in Figure 30. A SM4 GPS was linked to the detectors to record the route while driving. The detector was calibrated at the start of each transect drive. Table 6 (below) depicts transect details.

Table 6: Winter and spring transect data at the proposed Heuweltjies WEF

RESULTS FROM TRANSECTS	
Species recorded	**Number of bat passes**
T. aegyptiaca	6
N. capensis	2

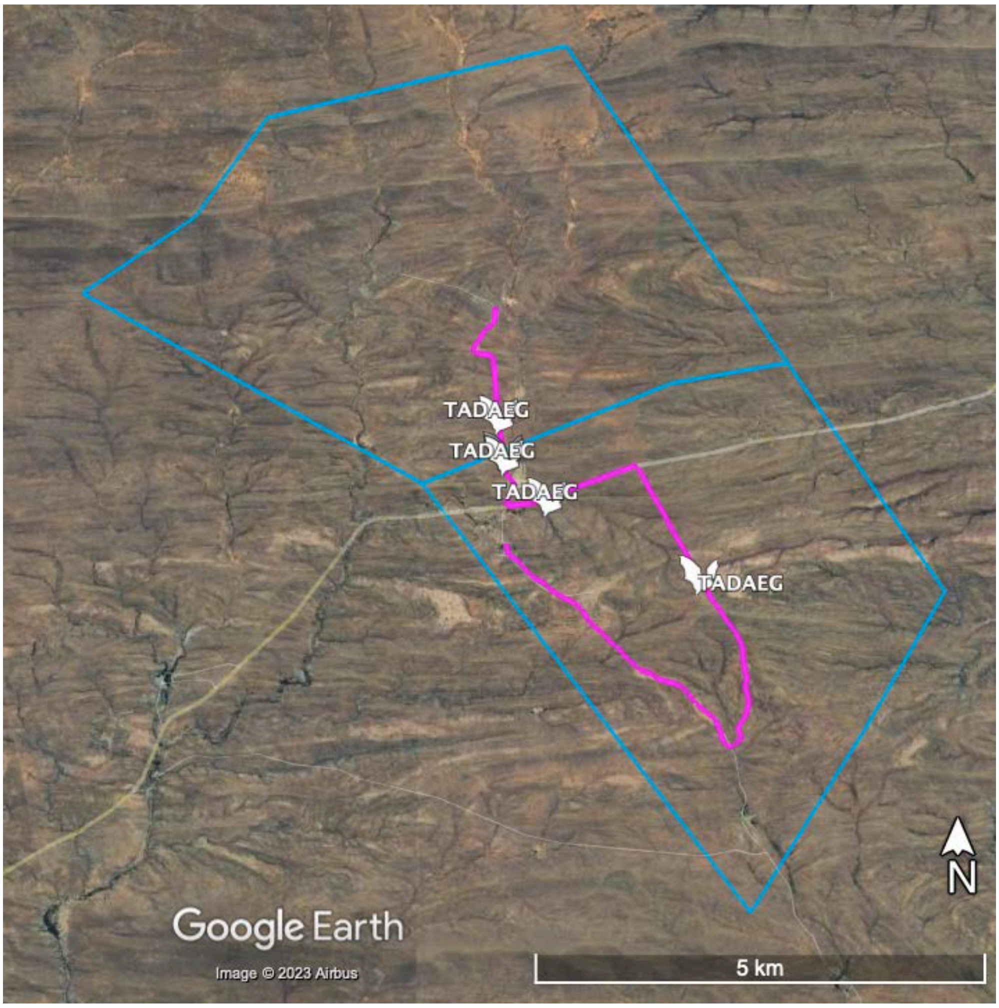


Figure 30: Transect route with the positions where bats had been recorded

7. BAT SENSITIVITY MAP

Sensitivity zones are based on recommendations for buffer areas, 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 and physically visiting the bat-conducive environments occurring at the development sites, and informed by static and active monitoring data.

The minimum buffer recommendation from SABAA is a 200 m buffer around all potentially bat-important features. Figure 31 has therefore incorporated a 200 m buffer as a minimum. For higher sensitivity zones, larger buffers are incorporated around bat-sensitive areas or bat roosts.

Sensitivity zones are relevant to all components of the turbines, including the tips of the turbine blades; therefore, should a turbine be installed in close proximity to a medium sensitivity zone, with the turbine tip within the sensitivity zone, then the mitigation of the medium zone should be applied to that turbine.

It is recommended that high bat sensitivity zones constitute 'no-go' development areas, i.e., where turning turbine components are not allowed. Medium sensitivity zones can be developed (turbines and associated infrastructure) with mitigation. No medium zones have been identified at the Heuweltjies terrain.

7.1 HIGH SENSITIVITY ZONES

High sensitivity zones are areas which should be avoided at all costs. This applies specifically to turbine placement, but includes laydown areas and other supporting infrastructure as far as possible, with the exception of roads and overhead powerlines. 'No-go' zones for turbine placement are recommended for the following areas:

- Hilly areas with rock formations and rocky ridges, wich are very limited at Heuweltjies WEF;
- Dry riverbeds with riparian shrub;
- Clumps of trees;
- Any other features conducive to bat roosts:
- 500 m buffer around human dwellings; and
- 200 m buffer around open water sources, including water troughs for livestock, reservoirs, dams, and some clumps of isolated trees.

Some of these features could be historic. For example, there may not be riparian shrubs currently present; however, the precautionary principle is valid for periods with increased rainfall where shrub may re-occur, as per the bat guidelines.

7.2 MEDIUM SENSITIVITY ZONES

Medium zones are areas that could be considered for development, but with mitigation. The developer has already mitigated medium sensitivity zones through careful placement of turbines so that no development will occur in medium sensitivity zones, see Figure 31 below.

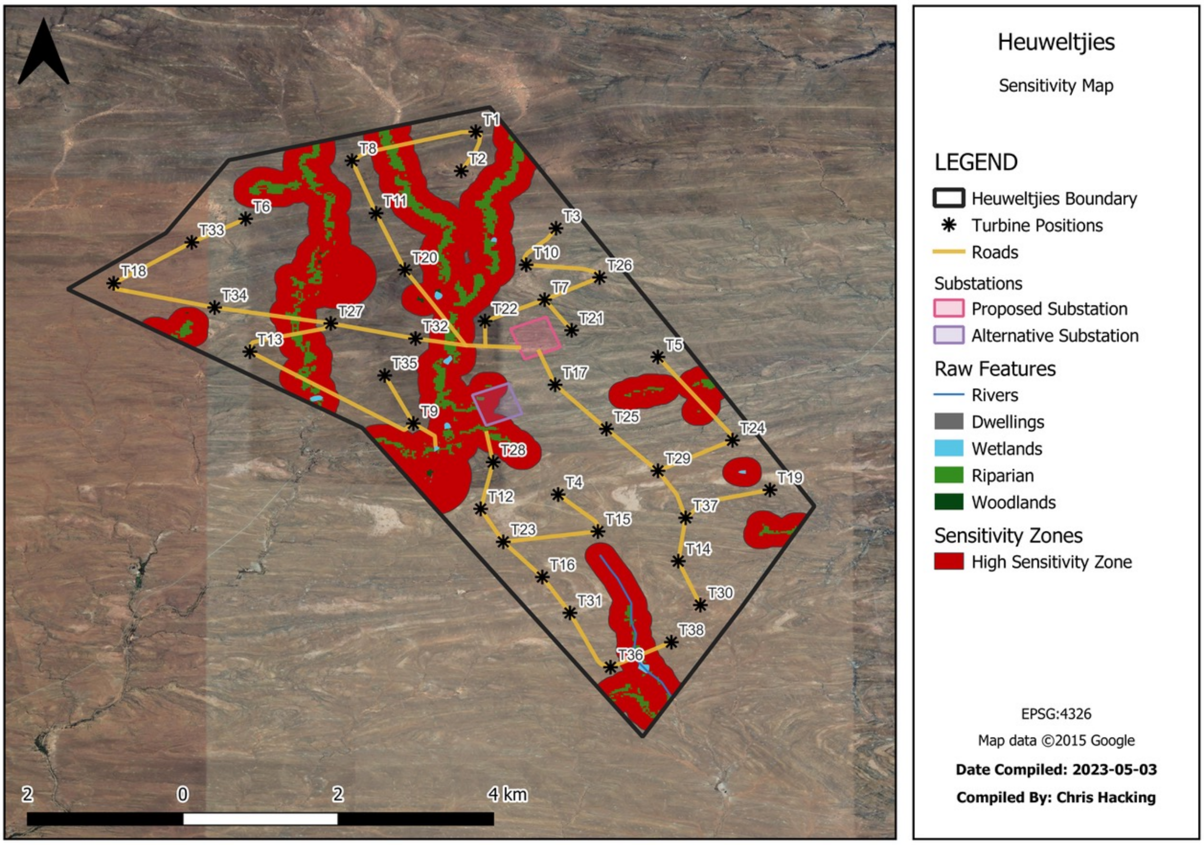


Figure 31: The bat sensitivity map for the proposed Heuweltjies WEF site

7.3 LOW SENSITIVITY ZONE

According to the SABAA threshold for Nama Karoo (MacEwan, 2020), the median hourly bat activity for the site is medium, both within the sweep of the turbine blades as well as at the near ground level, see Section 6.2. The areas not marked as high sensitivity zones, are seen as relatively low sensitivity and are available for development, subject to the general mitigation measures for the project site, as described in Section 9.

8. CUMULATIVE IMPACT

Strategic planning for the renewable energy portfolio of South Africa urges our future energy systems to be powered with clean electricity. The benefits of wind energy need to be assessed against the obligation for bat conservation concerns. All involved parties need to be informed of the trade-offs of the cumulative impacts of wind turbines on bat populations in their natural habitat, as the potential for wind turbines to affect bat populations should not be underestimated. Evaluating the potential effects and interactions between bat activity at wind facilities will inform decision-making to prevent or reduce the cumulation of negative impacts as wind energy development expands. NEMA protocol (32)(2)(k)(i) advises EIA and BA processes to identify and avoid "existing and potential impacts from similar or diverse activities or undertakings in the area".

Currently, in 2023, the DEFF requires a regional combined impact assessment of bat fatalities on other renewable energy facilities within a 35 km radius of the site as migratory and resident bats could cover large distances (Jacobs & Barclay, 2009; MacEwan, et al., 2018 and NEMA Regulations, 2022).

Table 7 contains a summary of features specific to the proposed Heuweltjies WEF and of bats confirmed on site. Figure 32 displays a view of the regional wind energy development featuring the proposed Heuweltjies WEF surrounded by renewable energy facilities within a 35 km radius interval to consider the cumulative impact on local and regional bats. Table 7 provides a summary of renewable energy facilities within a 35 km radius of the proposed Heuweltjies site, to assess 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 2020), as well as South African Bat Fatality Threshold Guidelines (MacEwan, et al., 2020).

Table 7: Site-specific information of cumulative impacts of the proposed Heuweltjies WEF and bats confirmed on-site.

Project size	4017 ha
Power Capacity	240 MW
Municipality and Province	Prins Albert Municipality, Central Karoo District Municipality in the Western Cape
Biome and Bioregion and Vegetation	Nama Karoo Biome, Lower Karoo Bioregion with Gamka Karoo Vegetation
Land use	Game farming and small livestock farming (Angora goats and Merino sheep)
Bat conducive features	Trees, riverbeds, unsealed roofs, derilict buildings, stagnant water, rock formations.
Period of high bat activity	Summer, spring and autumn recorded high activity with very low activity in winter
Period of low bat activity	Bat activity decreases during low temperatures in colder months and high winds
Bats confirmed on site	*T. aegyptiaca, N. capensis, S. petrophilus, M. natalensis, E. hottentotus*
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 impact and barotrauma	Bats that use the airspace of the rotor swept zone of the turbines

Static bat monitoring at the proposed Heuweltjies WEF at near ground level and rotor height confirmed bat occurrence and provided a year-round evaluation of bat activity. Open-air foragers with wing design and echolocation calls adapted to flying high above the vegetation and migratory species that fly over the proposed development site regardless of their foraging behaviour will mostly be at risk from turbine fatality. Reasons for high activity could be optimal weather conditions, insect emergence, as well as passage routes between roosting locations, including maternity roosts during breeding and birth seasons.

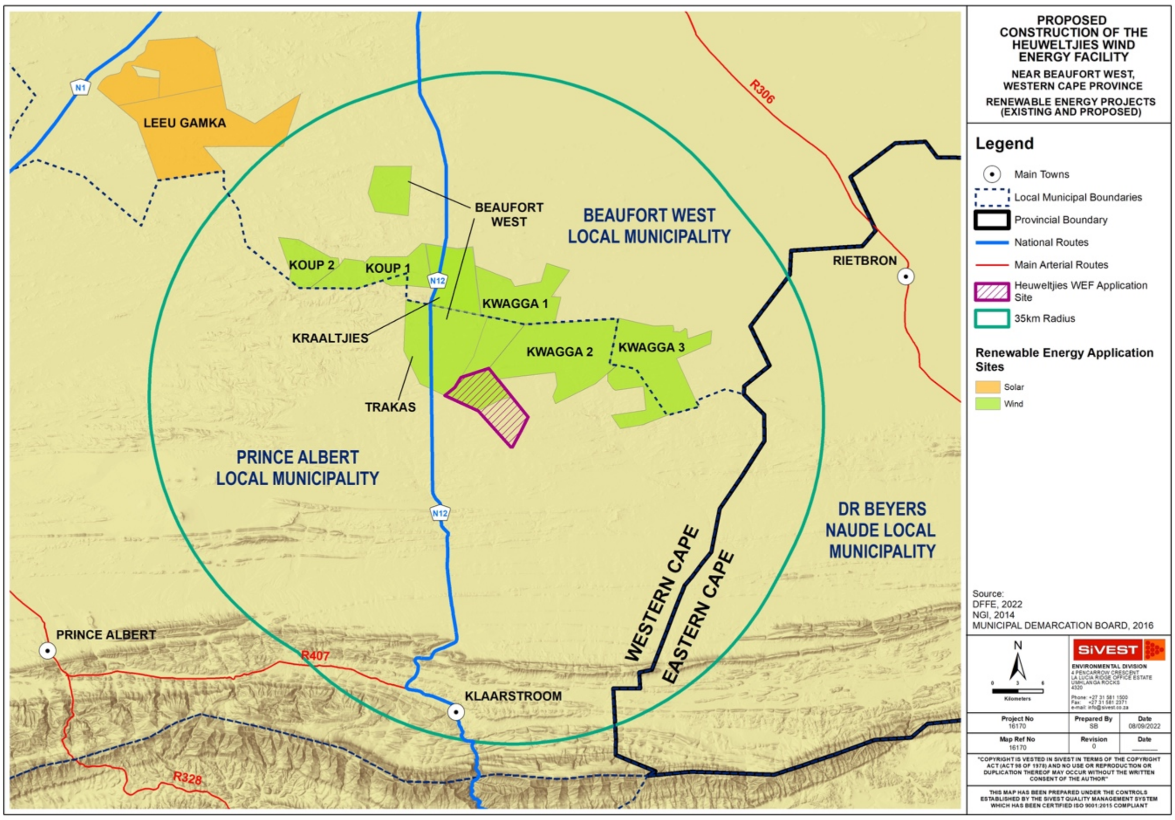


Figure 32: A larger zone of wind energy facilities (approved or at the proposal stage) within a 35 km radius of the proposed Heuweltjies WEF show the cumulative impact amplified across the area

As clusters of wind turbine development are created, it is expected that the cumulative effect will further increase as more wind farms are added. The major concern of cumulative impacts is direct mortality caused by collisions and barotrauma, as well as the indirect impact on ecological processes. Due to the back-to-back nature of the wind farms, the cumulative disturbance will be amplified across the area. These impacts could lead to the fragmentation of bat habitat and foraging and migration pathways, bat mortality and subsequent bat population decline. Should there be a decline in bat populations, there is the risk of elevated insect numbers and potential insect outbreaks in the vicinity of the wind farms as well as the greater region. Bats in the wider area would have to create corridors of movement to negotiate around these development zones.

The South African Bat Fatality Threshold Guidelines (MacEwan, et al., 2018) and Best Practice Guidelines (Sowler, et al., 2016) report results from early operational facilities in South Africa that show a linear increase in bat fatalities as more turbines are monitored. The South African Bat Fatality Threshold Guidelines (2020), recommend that threshold guidelines be calculated based on a formula representing the proportional bat occupancy per hectare for each of South Africa's Terrestrial Ecoregions. Threshold calculations add natural population dynamics and data on bat losses due to anthropogenic pressures to the sum to gauge the number of bat fatalities that may lead to population decline.

Table 8: Individual and cumulative features of the WEF cluster with annual average and median bat passes per hour for the monitoring period, based on bat recordings and risk levels indicated by the current and previous South African Bat Association Guidelines (Sowler, et al., 2017 and 2020 & MacEwan, et al., 2020)

RISK LEVELS AS PER SABAA 2020 GUIDELINES											
REFs within 35km radius of Heuweltjies WEF	Energy Ouput MW	Total Project Size (ha)	Bat Index based on Average Bat passes per hour compared to bat fatality risk levels for Nama Karoo biome >1.15	Median Bat passes per hour per year at rotor sweep level	Bat fatality risk levels based on Nama Karoo ecoregion: rotor sweep category (50-110m)	Bat fatality risk levels based on Median bat activity at rotor sweep level	Median hourly bat activity at near ground height	2020 Bat fatality risk levels based on Nama Karoo biome at near ground height (0-11m)	Bat fatality risk levels based on Median bat activity	Threshold based on ecoregion and total project size (ha): number of bats that can be removed before population decline may arise
Heuweltjies WEF	240	4017	1,36	0,42	0.03-0.42	Medium	0,85	0.18->1.01	Medium	42
Kraaltjies WEF	240	3995	1,62	0,39	0.03-0.42	Medium	1,35	0.18>1.01	High	43
Koup 1	140	4279	0,48							46
Koup 2	140	2477	0,41							26
Trakas	140	5340	1,30							57
Beaufort West	140	4123	0,79							44
Kwagga 1	279	5136	2,10							55
Kwagga 2	341	9214	2,10							98
Kwagga 3	205	9385	2,10							100
Total for all WEFs	1865	47966	12,26		>0.42	Medium		>1.01	Medium /High	510

Table 8 evaluates the potential cumulative impact of the WEF cluster surrounding the proposed Heuweltjies WEF. Some risk levels, such as was recorded at the proposed Koup 1 WEF, may be low, although the collective bat impact risk is high. The project-specific risk level for the proposed Heuweltjies WEF is high at an average bat activity of 1.36 bats per hour (Sowler, et al., 2016) and further increases the collective bat passes for the cluster to a significantly higher risk. The cumulative bat impact risk level based on average bat passes for the cluster of WEFs within a 35 km radius of the proposed Heuweltjies WEF is high, at 12.3 bat passes per hour. This places the cumulative effect in the high category for the estimated turbine-related fatality risk levels for Nama-Karoo. Additional wind energy developments (approved and proposed) within 35 km of the proposed Heuweltjies WEF, increase the total area to a much larger area or cluster of 47 966 ha and potential energy output to 1865 MW.

Solar PVC panels destroy the natural habitat and there is an indirect impact of loss of foraging area. However, the direct potential negative impact on bats by solar energy development is low and no solar projects within the 35 km radius have received authorization, so they are not included in the cumulative calculations.

Occasional inconsistencies occur 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 project or the footprint of the development. These inconsistencies limit the accuracy of calculating thresholds to gauge the extent of the cumulative impact. Project size rather than footprint size is used in these threshold calculations. It is noteworthy that the data available from some of the previously recorded studies recommend that bat activity levels be recorded and reported above 40 m height for bat fatality risk rating instead of below 11 m and above 52 m as presented in this report, which is based on the 2020 bat guidelines (MacEwan, et al., 2020). 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. Bat activity recorded at above 40 m could potentially be an accurate result for bat activity at rotor sweep level (Marais, 2015).

Bat activity calculations for studies of approved WEFs adjacent to the proposed Heuweltjies WEF and regional wind farms comply with previous and current guidelines. Therefore, Table 8 presents bat activity indices based on average and median calculations. The 'near ground' median for the proposed Heuweltjies WEF is 0.85 and the 'rotor sweep' median is 0.42. The median bat activity is medium compared to the bat fatality risk levels for the Nama Karoo. The recorded average bat index based on total bat activity is high at 1.36 and above the upper levels of the estimated turbine-related bat fatality risk of 1.15. Although bat indexes based on average bat passes are not required by the current 2020 bat monitoring guidelines for the proposed Heuweltjies WEF, they are recorded in Table 8. The bat indices calculations (average and median bat passes per hour per year) for the proposed Heuweltjies WEF are based on recordings done between August 2021 and November 2022 and are higher than the bat indices of surrounding WEFs recorded in previous years (between 2015 to late 2018). 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 reacts swiftly to weather condition fluctuations 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. Due to changing weather conditions, wind farms that recorded low activity during preconstruction bat monitoring, could experience unexpected increased bat fatality during operations. These fluctuations in bat activity should be considered when turbine development takes place.

Cumulative threshold calculations used in this report are not based on the number of turbines or MW but are based on fatality risk levels of each of South Africa's terrestrial ecoregions thresholds (MacEwan, et al., 2017 and 2020; Sowler, et al., 2020). The project size is used in this table and the threshold for the proposed Heuweltjies WEF is 43 bats, while the threshold for the total project size of all the WEFs within the 35 km radius area investigated is 510 bats. This is the number of bats that, in addition to natural population losses, can be removed from the area before their conservation status, or the ecosystem services they provide to the environment, are severely affected. These threshold calculations can be applied to any development that may result in bat fatalities (MacEwan, et al., 2020). Population decline thresholds are subject to ongoing discussion as little is known about fecundity rates, migration routes and population numbers of many bat species (SABAA.org.za, 2023). The threshold calculations derived from natural population dynamics and bat occupancy per ecoregion for the proposed Heuweltjies WEF for insectivorous bats should not exceed 43 bats per annum per family or species. Further mitigation measures, in addition to those in this report, must be implemented where site-specific thresholds are exceeded at the proposed Heuweltjies WEF. Threshold calculations for cumulative impacts on bats at the proposed Heuweltjies and surrounding WEFs within a 35 km radius should not exceed 510 bats per annum. Should the proposed development be approved, a monitoring program during the operational phase must include bat carcass searches to provide data to quantify bat fatalities.

Specialist reports from WEFs (Beaufort West and Trakas) considered in this cumulative assessment rate the impact high negative without mitigation which is reduced to low negative with proposed mitigation. Cumulative bat mortality due to direct collision or barotrauma during foraging of resident bats is rated high before mitigation and decreases to borderline medium/high after mitigation.

Stephanie Dippenaar has completed four two-year post-construction monitoring projects on other wind farms in the Nama-Karoo. These wind farms have a combined output of 360 MW. The combined average general estimated true fatality of these three wind farms is approximately 232 bats per year. Should these figures be extrapolated to the proposed Heuweltjies WEF over a 25-year lifespan, the total estimated true fatality could amount to approximately 5 800 bats. This is speculation at this point and the wind farms are situated in different areas and are affected by many variables. It is thus acknowledged that this is not a scientific way of calculating fatality over the lifespan of a wind farm. However, it gives an indication of fatalities that may occur over the lifespan of Heuweltjies WEF. As it is expected that the cumulative effect will increase as more wind farms are developed, thousands of bats could be killed, which could be significant for the function of the sensitive Karoo environment. This provides an indication of the severity of the cumulative impact over decades of wind energy generation. The application of mitigation measures at all the proposed WEFs may reduce the risk of bat population disturbance from a high to a lower impact, which can be verified through post-construction monitoring.

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 sensitive areas. Figure 31 indicates the sensitivity zones within the development area. The applicant has already shifted all turbine positions out of the high sensitivity areas.

Mitigation and enhancement options may be adjusted as this project develops to the operational phase, informed by growing knowledge in this field of study based on research and evidence gained from current development projects.

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 blades 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 and thereby increase 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. This mitigation measure must be implemented immediately on the installation of turbines, after the necessary tests on turbines have been concluded, but before the commercial operation date, and 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 TURBINE SPECIFIC RECOMMENDATIONS DURING THE OPERATIONAL PHASE

Currently, the most reliable and effective mitigation for bat mortality 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 barotrauma and collision with blades. 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 bat activity levels and weather conditions. Bat activity is typically reduced at higher wind speeds, lower temperatures, and a site-specific range of humidity and barometric pressure. Unfortunately, personal experience and unpublished data in South Africa indicate that *Molossidae* bats in Southern Africa fly at higher wind speeds than originally expected. Nevertheless, lower wind speeds and warmer temperatures typically correlate with higher bat activity levels, as seen in Section 6.3, and a percentage of bats could be saved by using weather conditions to predict bat activity.

This relationship between bat activity and weather conditions, as well as seasonal activity and nightly activity patterns, are used to inform curtailment schedules that should be applied when bat activity is high and which will reduce potential encounters of bats with wind turbine blades. These relationships are presented in Section 6.3 of this report and were used to compile the below curtailment schedule.

Records of bat activity and mortality resulting from monitoring during the post-construction phase, must inform, and refine the curtailment schedule, and be applied to specific turbines, as necessary. If curtailed turbines show consistently low activity through static recordings as well as mortality in the low threshold range, the bat specialist could adapt curtailment again.

There appears to be a clear correlation between bat activity and temperature and wind, and some correlation between bat activity and humidity at the proposed Heuweltjies WEF. Due to an insignificant correlation between barometric pressure and bat activity, the latter has not been applied to the curtailment recommendations. If this is proven otherwise during monitoring during operations, barometric pressure could be added for further refinement of curtailment.

Although no curtailment is recommended at present Table 9 below is provided as a starting point for curtailment discussions, should it be required during the operational phase. While there is uncertainty concerning the inclusion of September, October, and November in the schedule below, bat activity in September 2022 indicates higher activity during these months, if compared to 2021. Furthermore, juvenile bats often start flying from late October to November. Based on the precautionary principle of the EIA, these months are included in the below table. Should curtailment be applied during the operational phase the schecule must be refined, based on operational bat monitoring data, before application.

Table 9: Curtailment schedule to apply as necessary during the operational phase

Months	Time period	Temperature (°C)	Humidity	Curtailment
Jan, Feb, March	3 hours after sunset, up to 7 hours after sunset	Above 15 °C	Between 50% and 70%	Raise cut-in speed to 6 m/s

9.4 BAT DETERRENTS

Bat deterrent suppliers indicate that Molossidae bats react well to deterrents. This could be an option for mitigation as nearly 100% of all bat activity recorded by the systems situated within the sweep was that of Molossidae bats. At present one study related to South African bats has been conducted, but the results have not been released into the public domain yet. The study seems to be cautiously positive about the effectiveness of bat deterrents. 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 on site, while avoiding creating any features that might attract new 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 centimeter. If no bats are residing in the current building on site, the developer could discuss the situation with the landowner and seal the corrugated roofs of existing buildings to avoid any bat roosts in future.
- Any new quarries or burrow pits which could collect standing water must be rehabilitated.
- Apart from bat roosts at the farm buildings of Silverkaroo farm, no roosts were found during the 12-month bat monitoring study, but if any roosts are found during the construction or operational phase, a bat specialist should be consulted immediately.

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. Bat monitoring, including carcass searches, must start at the first turn of the turbine blades, after testing on 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 COD.

10. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BAT IMPACT

Criteria for the evaluation of impact, as provided by SiVest, and an explanation of the impact assessment tables, Sections 10.3 to 10.7, is attached as Appendix 5.

10.1 COMPONENTS OF THE PROJECT WHICH COULD IMPACT BATS

Components of the proposed Heuweltjies WEF which could negatively impact bats, directly through mortality or roost destruction during construction and operation, and indirectly, through the loss of foraging habitat, are as follows:

- 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;
- Creation of new buildings, such as the substation and BESS complex;
- Excavating areas or creating borrow pits (if required);
- Operation of wind turbines;
- Artificial lighting; and
- 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 characterised 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:

- *Loss of existing roosts and/or potential roosts*: Some of the bat species that occur on the proposed site are known to roost in rock formations, crevices, derelict aardvark holes and under the bark of trees (Table 2). Any disturbance of these natural roosting opportunities might have a negative impact on bats. Demolition of any existing buildings or bat habitat with active roosts, will kill a number of bats (Barclay and Harder, 2003).
- *Attracting bats by artificially creating new roosting areas*: The presence of new buildings within the study area may provide additional roost sites for those species making use of man-made structures. Quarries created during construction could serve as a further source of open water, and food if insects collect in these areas, which could attract bats.

Operational phase:

- *Direct collisions with rotating turbine blades:* The most important feature of the project that affects bats adversely are the operation of wind turbines, particularly 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 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 operational activities, such as noise after sunset from engines or generators might also deter bats, resulting in loss of feeding habitat.

The ideal with respect to managing the impact of WEFs on bats throughout the project's lifespan is to maintain bat populations as they occur on-site and avoid attracting more bats to the area of a potential collision.

10.3 DESIGN

Table 10: Rating of impacts that could potentially occur during the design 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
DESIGN PHASE																			
Turbine positions	Placing turbine positions in sensitive bat habitat	2	2	2	3	3	2	24	-	Medium	1	1	1	1	3	1	7	-	Low
MITIGATION MEASURE: ▪ Developer has already applied the mitigation measure of placing turbine position outside bat sensitive areas.																			

10.4 CONSTRUCTION

Table 11: 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 active bat roost and features that could serve as bat roosts, such as rock formations, removal of trees on site, destruction of derelict holes and fragmentation of habitat.	2	3	3	3	3	2	28	-	Medium	1	2	2	2	2	1	9	-	Low

MITIGATION MEASURES:

- Apart from associated infrastructure, construction activities to be kept out of all high bat sensitive areas as far as possible.
- Rock formations s should be avoided during construction as far as possible.
- Destruction of trees should be avoided as far as possible and in cases where trees have to be destroyed, care should be taken not to destroy bat roosts.
- Care should be taken if any dense bushes are destroyed so that no roosts are disturbed or 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, 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>Creating features which attract bats</td><td>Creating new habitat amongst turbines which might attract bats. This includes buildings with roofs that could serve as roosting space and open water sources, such as quarries or excavation areas, where water could accumulate.</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td><td>2</td><td>24</td><td>-</td><td>Medium</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:
▪ 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.
▪ Roofs need to be regularly inspected during the lifetime of the proposed WEF, and any new holes need to be sealed.
▪ 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>Construction activities</td><td>Construction noise, especially at night as well as light disturbance.</td><td>1</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td><td>18</td><td>-</td><td>Low</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>6</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:
▪ Nightly construction activities should be avoided, or if necessary, minimised to the shortest period possible.
▪ Except for compulsory civil aviation lighting, artificial lighting during construction should be minimised, especially bright lights or spotlights.
▪ Apart from avian lighting specifications, lights should avoid skyward illumination.
▪ Turbine tower lights should be switched off when not in operation, where possible.</td></tr>
</table>

10.5 OPERATION

Table 12: 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 (high risk) species have predominantly been confirmed at the proposed Heuweltjies WEF site.	2	4	3	3	3	3	48	-	High	2	4	3	3	3	2	30	-	Medium

MITIGATION MEASURES:

- All turbines and turbine components, including the rotor swept zone, should be kept out of all 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.
- 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.

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 SABAA guidelines as applicable during the monitoring period. ▪ Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist. ▪ Mitigation should be discussed between the bat specialist and developer during the operational phase and 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. ▪ Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats. ▪ 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, as possible. ▪ 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. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Heuweltjies WEF. Therefore, the installation of more than one monitoring system at height, is advised.																			
Fatality of migratory bats	Bat fatality during migration. Limited activity by *Miniopterus natalensis*, a Near Threatened migration species, had been recorded. Not much research has been conducted on migration of bats in South Africa, and some of the other species occurring on site could also migrate.	3	2	2	2	3	3	36	-	Medium	3	2	2	2	3	2	24	-	Medium

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:

- 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. Carcasses should be identified to establish the fatality of this species.
- 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.
- 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 SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, of bturbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.
- Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.
- 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.
- 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. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Heuweltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.

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																			
Loss of bats of conservation value	Bat fatality of bat species of conservation value. Calls similar to the red data *Miniopterus natalensis* have been recorded, as well as the endemic *Eptesicus hottentotus*.	3	3	2	2	3	3	39	-	Medium	3	2	3	2	3	2	28	-	Medium

MITIGATION MEASURES:

- Care should be taken during post construction monitoring to verify the activity of bat species of conservation value, especially within the rotor sweap area of the turbine blades.
- Proven species specific mitigation measures, such as curtailment or bat deterrents, should be timeously applied if high activity or high numbers of carcasses of bats of conservation value is recorded during post-construction.
- Bat carcasses should be identified to establish whether there are bats species' carcasses of conservation value.
- 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.
- 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 SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if high numbers of bats of conservations value are recorded, as advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high fatatlity of bats of conservation value 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																			
▪ Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats. ▪ 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. ▪ 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. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Heuweltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.																			
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.	2	2	2	2	3	2	22	-	Low	2	2	1	2	2	1	9	-	Low
MITIGATION MEASURES: ▪ 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.																			
Habitat loss	Loss of habitat and foraging space during operation of the wind turbines.	2	4	3	3	3	3	45	-	High	2	4	2	2	3	2	26	-	Medium
MITIGATION MEASURES:																			

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																			
▪ All turbines and turbine components, including the rotor swept zone, should be kept out of all high sensitivity zones. ▪ 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 SABAA guidelines as applicable during the monitoring period. ▪ Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist. ▪ Mitigation should be discussed between the bat specialist and developer during the operational phase and 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. ▪ Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats. ▪ 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. ▪ 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. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Heuweltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.																			
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	3	2	2	3	2	26	-	Medium	3	2	2	2	3	2	24	-	Medium

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:

- 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.
- 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 SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and 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.
- Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.
- 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.
- 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. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Heuweltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.

10.6 DECOMMISSIONING

Table 13: 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	3	1	2	1	1	8	-	Low	1	2	1	1	1	1	6	-	Low

MITIGATION MEASURES:

- Except for compulsory lighting required in terms of civil aviation, artificial lighting during decommissioning should be minimised, especially bright lights or spotlights.
- Night-time decommissioning activities should be avoided as far as possible.
- Develop a decommissioning and remedial rehabilitation plan and adhere to compliance monitoring plan.

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 14 below, with mitigation measures also provided.

Table 14: Rating of cumulative impacts

<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">CUMULATIVE IMPACTS</td></tr>
<tr><td>Destruction of active roosts on several WEFs.</td><td>Cumulative effect of destruction of active roost of several WEFs as well as features that could serve as potential roosts.</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td>42</td><td>-</td><td>Medium</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>2</td><td>26</td><td>-</td><td>Medium</td></tr>
<tr><td colspan="20">MITIGATION MEASURES:
▪ Although the developer does not have any control over other wind energy development, project specific mitigation, as included in the respective Bat Impact Assessments of the projects in the surrounding area, mitigation should be adhered to for each renewable energy project. This can however only be enforced by the regulating authority.
▪ Post construction monitoring as per the relevant South African guidelines should be applied at all wind farms in the vicinity.</td></tr>
<tr><td>Direct collision and barotrauma of several WEFs.</td><td>Cumulative bat mortality due to direct collision with the blades or barotrauma during foraging of resident bats at several WEF sites.</td><td>3</td><td>4</td><td>3</td><td>3</td><td>3</td><td>3</td><td>48</td><td>-</td><td>High</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td>3</td><td>45</td><td>-</td><td>High</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
MITIGATION MEASURES: ▪ Although not enforceable by the Heuweltjies 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. ▪ 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	2	2	3	3	3	36	-	Medium
MITIGATION MEASURES: ▪ Although not enforceable by the Heuweltjies 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. This can however only be enforced by the regulating authority. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			
Habitat loss over several WEFs	Several WEFs stretching over thousands of hectares.	3	4	3	3	3	3	48	-	High	3	4	2	3	3	2	30	-	Medium
MITIGATION MEASURES: ▪ Although not enforceable by the Heuweltjies 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. This can however only be enforced by the regulating authority. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			

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
Reduction in the size, genetic diversity, resilience, and persistence of bat populations	Several wind farms with associated bat mortality reducing the size, genetic diversity, resilience, and persistence of bat populations over the lifespan of WEFs.	3	3	3	3	3	3	45	-	High	3	3	3	3	3	3	42	-	Medium

MITIGATION MEASURES:

- Although not enforceable by the Heuweltjies 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. This can however only be enforced by the regulating authority.
- Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.

10.8 OVERALL IMPACT RATING – PROPOSED HEUWELTJIES WEF

The combined overall impact of the Heuweltjies 240 MW WEF, is predicted to **Medium Negative** before mitigation and **Low Negative** after mitigation, see Table 15 It should be noted that although the operational combined negative impact on the bat activity on the project site is Medium, the fatality through direct collision or barotrauma of resident bats occupying the airspace amongst the turbines is rated as Medium after mitigation due to the predominantly high-risk species recorded on the site. The developer should therefore keep in mind that bat fatalities could be significant during operation and should buget for turbine specific mitigation measures if necessary.

Table 15: Summary table of expected impacts associated with the proposed Heuweltjies WEF

Summary of impacts (average of each section) on bats by the Heuweltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24(5-23) Medium	7(5-23) Low
Construction	23 (5-23) Low	6,7 (5-23) Low
Operation	36(24-42) Medium	22,8 (5-23) Low
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	45,6 (43-61) High	35,8 (24-42) Medium
Combined for the site	34,1 (24-42) Medium	21,8 (5-23) Low

11. COMPARATIVE ASSESSMENT OF ALTERNATIVES

11.1 'NO-GO' ALTERNATIVE

The landowners of the proposed up to 240 MW Heuweltjies WEF assured the bat specialist that they do not foresee any changes in the land use should the wind farm not be developed. Therefore, should the proposed WEF development not go ahead, none of the identified potential impacts would occur and the status quo would be maintained.

11.2 LAYOUT ALTERNATIVES

No layout alternatives for the proposed Heuweltjies WEF have been proposed or assessed as the position of the wind turbines and overall layout of the proposed WEF have been informed by the identified sensitivity areas and their relevant buffers (where required). However, two site alternatives for the substation, laydown area and BESS were provided and have been comparatively assessed.

Table 16 below provides the results of the comparative assessment from a bat perspective.

Table 16: Comparative assessment of substation, laydown area and BESS

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION SITE, CONSTRUCTION LAYDOWN AREA, BESS ALTERNATIVES		
Proposed substation, laydown area and BESS	Favourable	The area is situated outside the high-sensitivity zones and does not infringe on any bat sensitivity buffers.
Alternative substation, laydown area and BESS	Least preferred	A part of the area will be situated within a high-sensitivity area. Although this would be acceptable as there would not be any direct impact on bats if no roosts are destroyed, it will be situated in an area which is more utilised by bats.

Based on the results of the comparative assessment of alternatives, the proposed position of the substation, laydown area and BESS is the preferred option.

Although the alternative positions of the substation, laydown area and BESS is stated as the least preferred option due to the infringement on a high sensitivity area for bats, if no bat roosts are destroyed, the impact of this infrastructure is not predicted to be high and therefore there are no fatal flaws associated with the alternatives.

12. CONCLUSION AND SUMMARY

12.1 SUMMARY OF FINDINGS AND RECOMMENDATIONS

Five of the 12 bat species which have distribution maps overlaying the proposed WEF were recorded during the bat monitoring. According to the likelihood of fatality risk, as indicated in the latest pre-construction guidelines, four of these species have a high risk of fatality, with one species having a medium risk of fatality.

76% of the calls at all the systems represent *Tadarida aegyptiaca*, which is the dominant species on site. This is a high-risk species, physiologically adapted, with a narrow wingspan, to fly high in the vicinity of the turbine blades where the risk of collision and barotrauma is high. 16% of the activity was from calls like that of *Neoromicia capensis,* 8% was for *Sauromys petrophilus,* while statistically insignificant numbers of the endemic *Eptesicus hottentotus* and the Near Threatened *Miniopterus natalensis* were also recorded at the site. The Molossidae family is more dominant at the high-altitude systems, with the Molossids *S. petrophilus* and *T. aegyptiaca* comprising nearly 100% of all the activity recorded at height (Systems J and K).

The proposed Heuweltjies WEF recorded low bat activity during winter, between May and August, with a steady increase in activity from September (spring) to late summer (February) and the beginning of autumn (March). The highest activity was experienced between January and March. The relatively high activity in September 2022 was not portrayed again in September 2021, which could have been due to a later onset of warmer spring temperatures during 2021.

The general distribution of bat activity each night, from sunset to sunrise, indicates a steady increase in activity from sunset, with bat activity rising steadily until a peak around midnight, whereafter activity declined up to about four hours before sunrise, with little activity thereafter. Apart from a relatively higher peak earlier in the evening at the 98 m system, all the systems indicate the same pattern of activity with small variations. This could imply a fairly uniform nightly activity pattern over the site as a whole.

The combined median bat activity per hour at the near-ground level is 0,85, while the combined median bat activity per hour within the rotor sweep area is 0,42. Although, according to the SABAA guidelines, these are both within the medium-risk category, the rotor sweep activity of 0,42 bats per hour is on the border of medium and high risk. The rotor sweep median is of particular importance, as this represents the overall hourly bat activity within the proposed sweep of the turbine blades, and thus in the area of expected collision risk. It is therefore recommended that operational bat monitoring establish whether bat activity in the rotor-sweep area consistently remains within the medium risk category with changing weather conditions.

Data from the 98 m System J and 52 m System K 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 10 °C, wind speeds below 11 m/s and humidity levels between 40% and 70%. A bat sensitivity map which designated high sensitivity areas is presented below. The client has already applied mitigation by shifting all turbine positions outside of high sensitivity zones, so that no operating turbine components are placed in these areas. Supporting infrastructure, such as the roads, laydown area, on-site sub-station and the Battery Energy Storage System may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any destruction of possible bat roosts, as per the EMPr.

Although no curtailment is recommended at present, a curtailment schedule is presented in Section 9.3, Table 9, of the main document. This must be included in the operational bat monitoring program so that the operational bat specialist can adapt mitigation measures and include these recommendations as necessary.

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Low Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Nama

Karoo, is medium. This must be confirmed during bat monitoring in the operational phase, but the developer should not rule out turbine-specific curtailment and/or installing bat deterrents when more information is available.

As indicated in the table below, the impact on bats from the proposed Heuweltjies WEF project site is predicted to be Negative Medium, with a combined rating of 34,1 before mitigation and Negative Low, with a combined rating of 21,8 after mitigation.

Summary of impacts (average of each section) on bats by the proposed Heuweltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24 (5-23) Medium	7(5-23) Low
Construction	23 (5-23) Low	6,7 (5-23) Low
Operation	36 (24-42) Medium	22,8(5-23) Low
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	45,6 (62-80) High	35,8 (24-42) Medium
Combined for the site	34,1 (24-42) Medium	21,8 (5-23) Low

The cumulative impacts on bat populations at the proposed Heuweltjies WEF, before mitigation, are predicted to be High Negative. This is due to the combined impact of all the proposed wind farms in the area. If all wind farms in the vicinity adhere to recommended mitigation measures, the combined cumulative impact is predicted to be reduced to Medium.

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 above and in Section 7 of the main report.
- A bat specialist must be appointed before the Commercial Operation Date (COD). A mitigation scheme, as per Section 9 in the main report, must form part of the operational EMPr, and be applied on site.
- 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.
- Mitigation measures must be applied as outlined in the impact tables, Section 10, of the main report and the EMPr.
- Should high fatality rates, above the fatality threshold of the relevant guidelines, be experienced during operation , curtailment, as indicated in Section 9 of the main report, must be adapted, or bat deterrents must be installed, as guided by the operational bat specialist.
- 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 regular investigation should establish if new roofs are still sealed.
- A minimum of two year's operational bat monitoring must be conducted after the commencement of operations at the proposed WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

12.2 CONCLUSION AND IMPACT STATEMENT

The Site Sensitivity Verification Report indicates that the area proposed for the proposed Heuweltjies WEF has areas of high bat sensitivity. Some of the drainage lines, with relatively large trees and dense bushes, are particularly conducive to bat activity, as confirmed in the Site Sensitivity Verification Report. However, according to the SABAA bat threshold, the site as a whole, with the data from the monitoring period, is indicated as medium sensitive for bats. Areas between the high sensitivity zones portrayed lower activity and are therefore available for turbine development.

It should be noted that one year pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Nama Karoo environment is subject to erratic weather conditions, which vary from year to year. As confirmed by operational wind farms, bat fatalities could fluctuate significantly, depending on weather conditions. These changes cannot be accounted for in a year of bat monitoring.

The overall potential negative impact of the proposed Heuweltjies WEF on bats, combined for all the development phases, is predicted to be **Medium Negative without mitigation**, and **Low Negative with mitigation**.

Based on the findings of the one-year pre-construction monitoring undertaken at the proposed up to 240 MW Heuweltjies 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. Environmental Authorisation may thus be granted, subject to the implementation of the recommendations made in this report.

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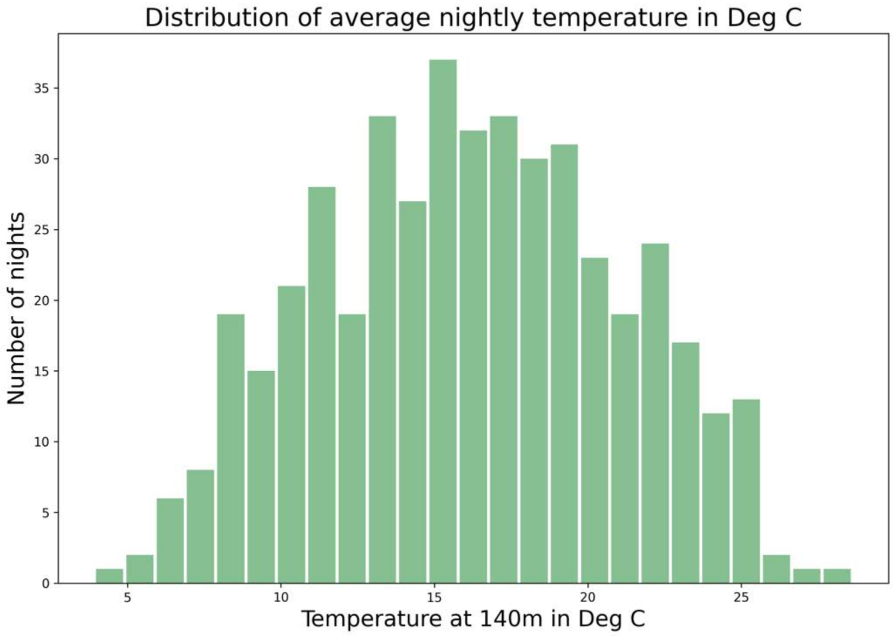
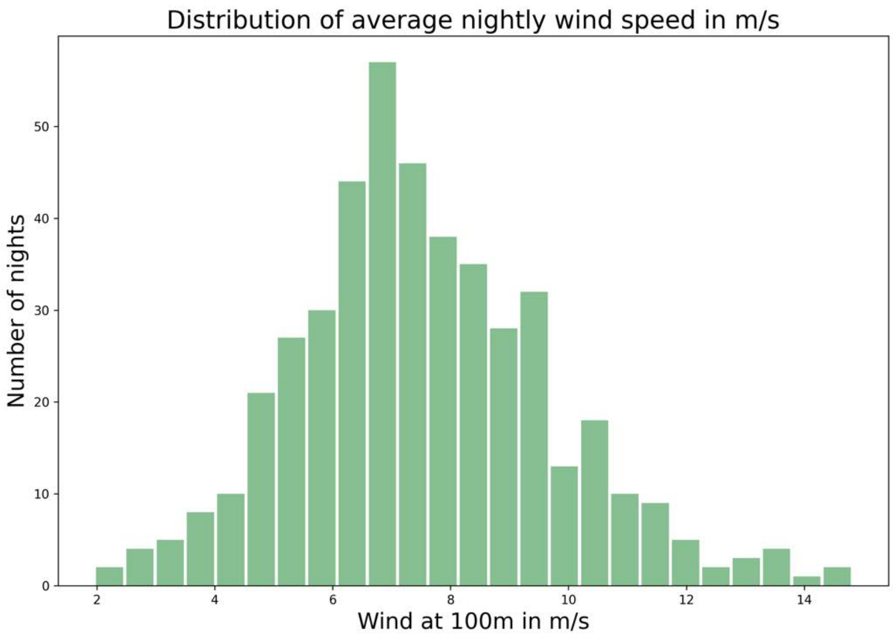
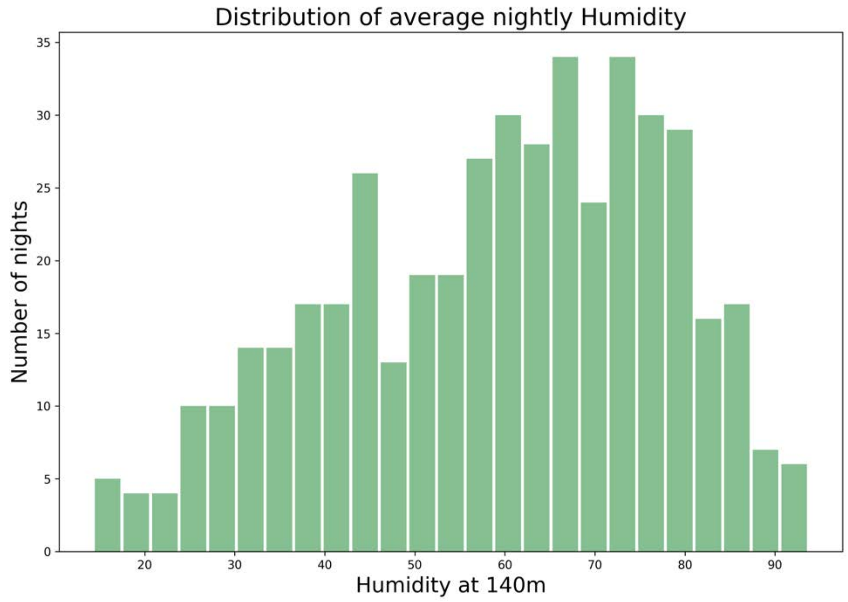
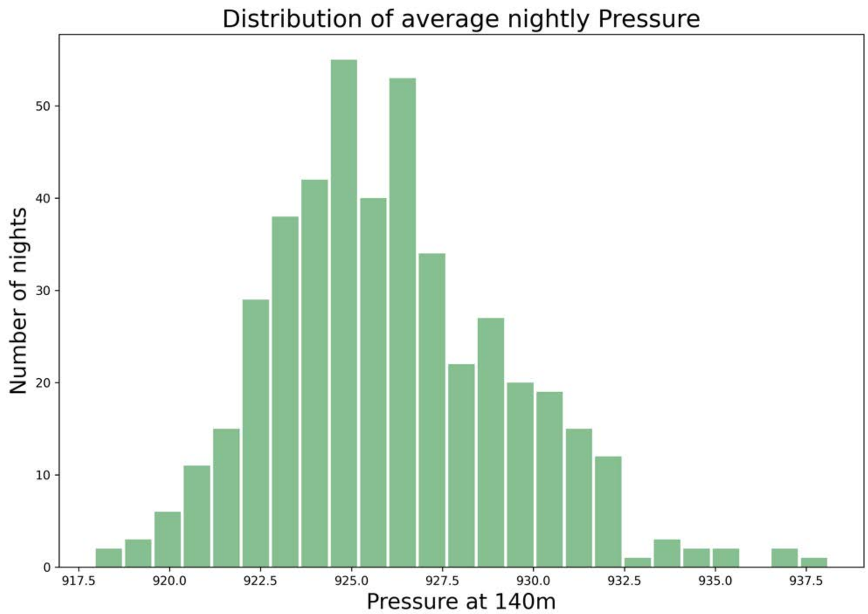
APPENDIX 1: WEATHER DISTRIBUTIONS OF AVERAGE NIGHTLY WEATHER CONDITIONS


Distribution of average nightly temperature in Deg C
Number of nights
0
5
10
15
20
25
30
35
5
10
15
20
25
Temperature at 140m in Deg C


Distribution of average nightly wind speed in m/s
Number of nights
0
10
20
30
40
50
2
4
6
8
10
12
14
Wind at 100m in m/s


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


Distribution of average nightly Pressure
Number of nights
Pressure at 140m
50
40
30
20
10
0
917.5
920.0
922.5
925.0
927.5
930.0
932.5
935.0
937.5

APPENDIX 2: SPECIALIST CV

ABBREVIATED CURRICULUM VITAE:

STEPHANIE CHRISTIA DIPPENAAR

Stephanie Dippenaar Consulting, trading as EkoVler

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, focusing 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 Kangnas Wind Farm	Bat specialist
In progress	Operational bat monitoring at Perdekraal East Wind Farm	Bat specialist
2022	Preconstruction Bat monitoring at Latrodex Wind Energy Facility, Haga Haga	Bat specialist
2022	Preconstruction Bat monitoring at Juno 2 and Juno 3 Wind Energy Facilities	Bat specialist

Completion	Project description	Role
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
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
2021	Desktop bat screening report: Calvinia renewable energy clusters	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

Completion	Project description	Role
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 180 MW 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
2009-2010	EIA for the NamWater Desalination Plant, Swakopmund (Authorisation received).	Project Manager
2007 -2011	EIA for the proposed Jacobsbaai Tortoise reserve, Western Cape (Left 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.
- Member of the KZN Bat Rescue Group.
- 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. Eleanor 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.

APPENDIX 3: SITE SENSITIVITY VERIFICATION

SITE SENSITIVITY VERIFICATION REPORT: PROPOSED HEUWELTJIES 240 MW WIND ENERGY FACILITY

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

1. Introduction

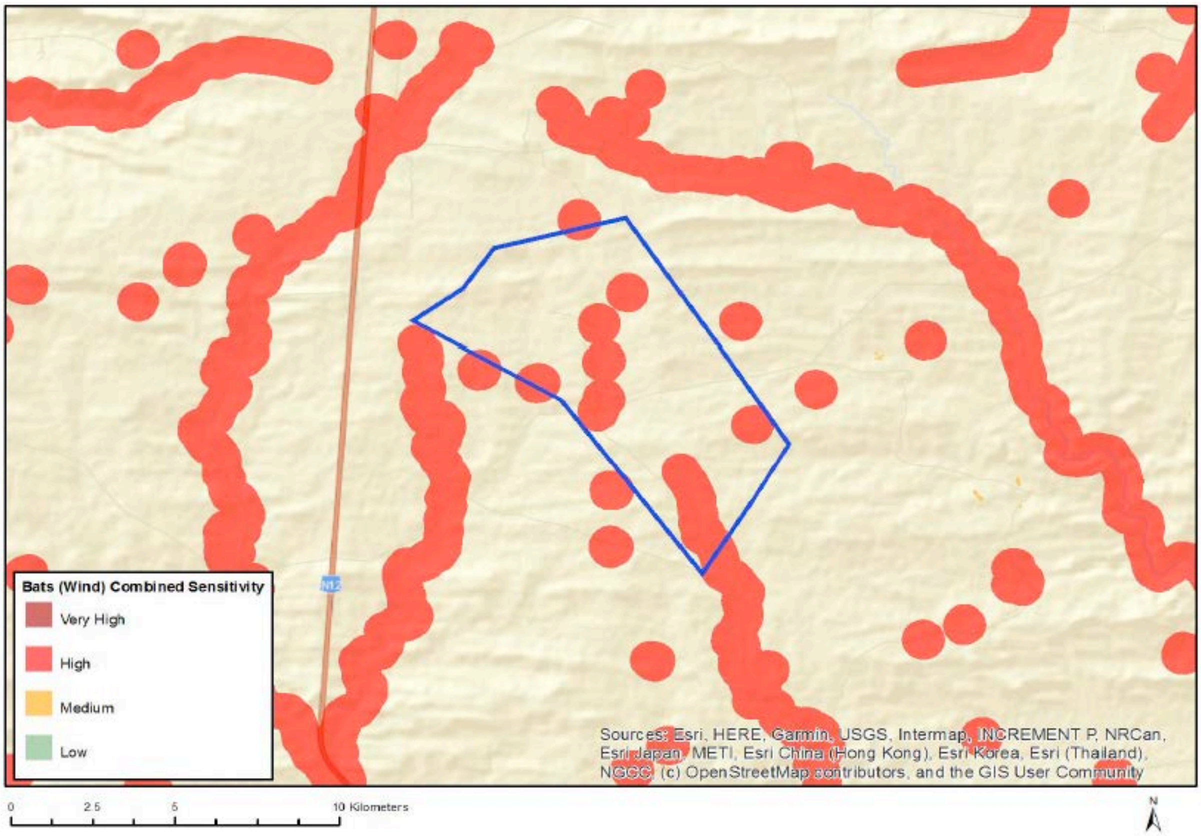
South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing to construct up to a 240 Megawatt (MW) Wind Energy Facility (WEF), known as the Heuweltjies up to 240 MW Wind Energy Facility (WEF), with associated infrastructure, located within the Prince Albert Local Municipality in the Central Karoo District Municipality.

The project site is located on the remainder of the Farm Witpoortje No.16 and Portion 8 of the Farm Klipgat No.114, within the Prince Albert Local Municipality in the Central Karoo District Municipality. The site is located en route to Beaufort West, in the Western Cape Province. A 240 MW WEF, including turbines and associated infrastructure is proposed, covering a study area of 4 017,60 ha.

Stephanie Dippenaar Consulting, trading as EkoVler, has been appointed to conduct a 12-month pre-construction bat monitoring, to inform the Environmental Assessment process for the proposed WEF. This pre-construction bat monitoring commenced in June 2021. Data between 11 June 2021 and 27 June 2022 is included in this bat monitoring report.

2. Site sensitivity verification

The national web-based environmental screening tool, according to the Specialist Assessment Protocols published in GN 320 on 20 March 2020, was applied to the study area. This was undertaken to confirm the current land use and environmental sensitivity of the proposed project area. 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-sensitive features at the proposed Heuweltjies WEF site, as per the site sensitivity report

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

- 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, consisting of nightly bat activity, was recorded between 15 August 2021 and 12 November 2022, from four static monitoring points, which were positioned amongst the proposed turbine blades at heights of 8 m , 10 m, 52 m and 98 m respectively. The systems represented the different altitudes and differenct biotopes within the project site.
- Interviews with landowners and investigations of farm dwellings and bat conducive features were conducted.

3. The outcome of THE site sensitivity verification

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

Table A: Environmental features that may be favourable to bats.

	**Vegetation** Although most of the site is covered in Gamka Karoo vegetation typical of the area, trees situated in the dry riverbeds could provide roosting opportunity for bats that prefer roosting in vegetation or under the bark of trees.
	**Rock formations and rock faces** Rocky outcrops and rock formations along the low ridge lines, and along river valleys, could provide ample roosting opportunities for bats.
	**Open water and food sources** Water troughs for the livestock and associated open cement reservoirs could also provide permanent, open water sources for bats throughout the year.
	**Human dwellings and farm buildings** Existing buildings, especially where roofs are not sealed, or uninhibited, derelict buildings could provide roosting opportunities. Although bat roosts were not found at the proposed Heuweltjies WEF up until now, in similar environments with limited roosting opportunities, bat roosts are regularly found in buildings. Roosts searches will be ongoing and continue in the operational phase.

As indicated in the Screening Tool Site Sensitivity Map, Figure B, the project site is classified as high sensitivity due to the availability of natural water resources. The 12 months of bat monitoring data analyses have confirmed some areas of high bat sensitivity, with added sensitivity zones on the site sensitivity map, see Figure B. The site's median hourly bat activity as recorded during the monitoring year is within the medium threshold category as in dicated by the *South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities* (MacEwan, et al. 2020).

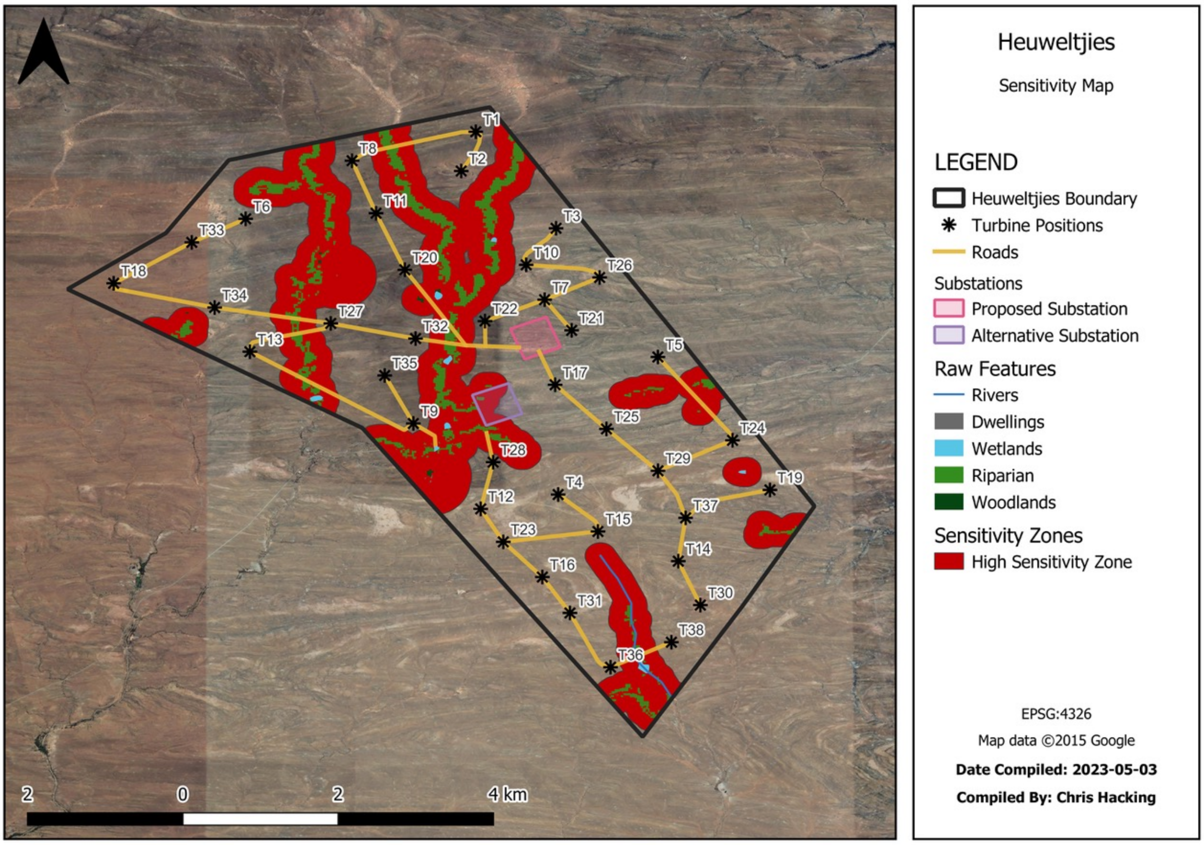


Figure B: Bat sensitivity map at the proposed Heuweltjies WEF, as confirmed during the 12-months bat monitoring

Table B below indicates the height-specific bat activity and fatality risk according to the South African pre-construction bat guidelines (MacEwan et al., 2020) together with the median of hourly bat activity at height over the monitoring period, from Systems K, at 52 m and System J, at 98 m, and near ground level, from Systems L and M, between 8 m and 10 m respectively. The combined median bat activity per hour at near-ground level is 0,85, while the combined median bat activity per hour within the rotor sweep area is 0,42. Both are classified as within the medium-risk category. Therefore, the site sensitivity as depicted by the Screening Tool, is partially correct, indicating areas of high sensitivity, but the bat activity for the monitoring year is within the medium risk category. Furthermoe, there are low sensitivity areas between the high sensitivity areas, as indicated by Figure B, where wind turbines could be developed.

Table B: The bat fatality risk threshold for Nama Karoo with the median from within the sweep of the proposed turbine blades and from lower near ground monitoring systems (MacEwan et al., 2020)

Ecoregion	**Height category***	**Low risk** (Median bat passes/hour)	**Medium risk** (Median bat passes/hour)	**High risk** (Median bat passes/hour)
Nama Karoo	Near ground	<0,18	0,18 – 1,01	>1,01
	Rotor sweep	<0,03	0,03 – 0,42	>0,42
Height of monitoring systems at the proposed Heuweltjies WEF			**Median of hourly bat activity for the monitoring period**	
Combined activity from 10 m systems (L, M) near ground.			0,85	
Combined activity from 52 m (K) and 98 m (J) in the rotor sweep area.			0,42	

4. Conclusion

The Site Sensitivity Verification Report indicates the proposed Heuweltjies WEF area has high bat sensitivity. Some of drainage lines in the southwestern and southeastern areas, with some relatively larger trees and denser bushes, are particularly conducive to bat activity and would be classified as high sensitive area, but the median bat activity is indicated as medium. The site sensitivity as depicted by the Screening Tool, is partially correct, indicating areas of high sensitivity. There are, however, low sensitivity areas between these, as indicated by Figure B, where wind turbines could be developed.

APPENDIX 4: 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

Environmental Impact Assessment for the proposed Heuweltjies 240MW Wind Energy Facility

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:	Sole proprietor: 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 Dippenaar			
Specialist Qualifications:	MEM (Masters in Environmental Management)			
Professional affiliation/registration:	SAAIES			
Physical address:	8 Florida Street, Stellenbosch			
Postal address:	8 Florida Street, Stellenbosch			
Postal code:	7600	Cell:	0822005244	
Telephone:	0822005244	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]

Signature of the Specialist

Stephanie Dippenaar Consulting

Name of Company:

1 March 2023

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

Name of Company

1 March 2023

Date

Signature of the Commissioner of Oaths

Date

Certify a true copy of the original document with reflects no apparent unauthorized alterations.
Gesertifiseer 'n ware afskrif van die oorspronklike dokument waarop geen klaarblyklike ongemagtigde wysigings aangebring is nie.

JJ. JULIUS 17453149

COMMISSIONER OF OATHS / KOMMISSARIS VAN EDE

DATE/DATUM: 1/03/2023

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

APPENDIX 5: SIVEST IMPACT ASSESSMENT METHODOLOGY

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.