HUGO WIND ENERGY FACILITY: PRECONSTRUCTION BAT MONITORING

BAT SCOPING REPORT

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energy TEAM

EkoVler

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executive summary

Stephanie Dippenaar Consulting, trading as EkoVler, has been appointed by FE Hugo & Khoe (Pty) Ltd to conduct a bat study to feed into the EIA process for the proposed Hugo Wind Energy Facility (WEF). The project site is located west and east of the R318, the road between Montagu and De Doorns. It is situated within the Breede Valley and Langeberg Local Municipalities within Cape Winelands District Municipality of the Western Cape Province.

Bat monitoring started in December 2022, when the met mast was installed and this report details the data collected between 30 December 2022 and 12 August 2023. The monitoring systems deployed within the study area consist of six Wildlife Acoustics SM4BAT full spectrum bat detectors, recording data from the met mast at 100 m, 50 m and 10 m, as well as from three temporary 10 m masts. This allows for coverage of all the biotopes in the area. During fieldwork, physical surveys are conducted to identify the location of possible roosts. Interviews were also conducted with people staying on-site or close to the site, to establish if they are aware of any roosts in the vicinity, or general bat occurrences.

The proposed study area falls within the Fynbos Biome, with Matjiesfontein Quartzite Fynbos, Matjiesfontein Shale Renosterveld, North Langeberg Sandstone Fynbos and a small section of South Langeberg Sandstone Fynbos being represented on site.

There are several areas of conservation value in the region of the proposed Hugo WEF, but none of these borders the proposed wind farm. The nearest registered reserve, the Bokkeriviere Nature Reserve's southern border is situated about 5 km from the northern border of the proposed terrain. In addition, the Hugo WEF overlaps with the Matroosberg Mountain Catchment Area, which stretches towards a southwesterly direction beyond the Hugo WEF.

There are some perennial and several non-perennial water bodies situated on the site and in the surrounding areas. Not only could these provide water for bats to drink, but stagnant water could be a breeding ground for insects, which in turn attracts bats. Rock formations along the hilltops and the river valleys and several human dwellings could provide ample roosting opportunities for bats. The southeastern border of the site presents particularly numerous roosting opportunities in the rocky outcrops. Bats from surrounding farms could furthermore traverse the proposed wind farm to forage and drink.

Of the 12 species with distribution ranges that include the proposed development area, four have a conservation status of Near Threatened in South Africa and one Vulnerable, while three have a global conservation status of Near Threatened.

According to the likelihood of fatality risk, as indicated by the latest pre-construction bat guidelines six species, namely *Miniopterus natalensis* (Natal long-fingered bat), *Tadarica aegyptiaca* (Egyptian free-tailed), *Sauromys petrophilus* (Roberts's flat-headed bat), *Neoromicia capensis* (Cape Serotine bat), lately called *Laephotis capensis* (Cape roof bat) and the two Pteropodidae species (fruit bats) have a high risk of fatality, while *Myotis tricolor* (Temminck's myotis bat) has a medium-high risk and the endemic *E. hottentotus* has a medium risk of fatality.

Calls like five of the 12 species that have distribution ranges overlaying the proposed development site were recorded by the static recorders. 63% of the calls were from *Neoromicia capensis (Laephotis* *capensis)*, which is the dominant species on site. The second highest percentage of calls were from *Tadarida aegyptiaca* (28%), which is physiologically adapted to flying high and is thus at high risk of fatality, followed by the global as well as regional Near Threatened *Miniopterus natalensis* (7%), then *Sauromys petrophilus* (1%) and the endemic *Eptesicus hottentotus* (1%).

In total, nearly 100% of the bats recorded at the two high systems on the met mast (Systems A and B) belong to the two Molossidae species, *T. aegyptiaca* and *S. petrophilus*, while activity by *N. capensis (L. capensis)* is more active at the 10 m systems. When the present data is considered bat activity as well as species diversity are higher at lower altitudes at the proposed wind development.

Weekly temporal distribution of bat activity over the monitoring period generally indicates higher activity during autumn, from March to May 2023, with notably high activity by *N. capensis (L. capensis)* during these months. A sharp decline in activity was recorded towards the end of May, followed by low activity during the colder months, namely June to August.

When observing the species distribution at different monitoring systems, *N. capensis* portrays the highest recorded activity, with significantly more activity recorded at the 10 m masts and a near absence at higher altitudes. *T. aegyptiaca* portrayed the second highest activity and although this bat is widespread at the site, higher activity was recorded at 100 m (A) and 50 M (B) on the met mast. The highest activity of the Near Threatened *M. natalensis* was recorded at the 10 m mast L, situated near the centre of the site.

In general, there seems to be a decline in activity when observing the Hugo WEF bat data. If medians of the various systems are taken into consideration, the difference in bat activity at 100 m, 50 m and 10 m systems can be observed. There seems to be a decline in activity with increased altitude at the met mast, with System A, situated at 100 m, portraying lower activity when compared to System B, at 50 m, while System C, situated at 10 m portrays the highest activity on the met mast. The four 10 m systems (C, J, K and L) all recorded higher activity than the two systems at height (A and B).

Activity across all the systems increases at sunset, with a gradual incline in activity about an hour after sunset. Most systems recorded peak activity at approximately an hour after sunset (10 m Mast G) to approximately two hours after sunset (100 m A, 50 m B, 10 m C on the met mast, and 10 m Masts J, K, L). In general, a very peculiar pattern of high activity around sunset, with a gradual decline by the hour towards sunrise is seen. Bats at Hugo WEF seem to remain active up to the early morning hours when they return to their roosts before sunrise.

Extra care is taken with activity at Systems A and B, as these systems are situated within the sweep of the turbine blades with high activity from *T. aegyptiaca.* If present data of operational wind farms are considered, this species has the highest risk of fatality. The final report will provide a more complete picture of the whole monitoring period, indicating possible mitigation measures to curb predicted bat activity, if necessary.

A preliminary bat sensitivity map was compiled with the available data up to now. The bat sensitivity zones still need to be refined, incorporating data from the whole monitoring year; Therefore, there will be some changes in sensitivity zones.

In general, there are no red flags at this stage that suggest that the development could not progress to the next phase. However, this can only be confirmed when 12 months of bat monitoring has been considered. Correlations between bat data and weather conditions will be included in the final bat monitoring report.

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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

Glossary

Definitions	
Bat monitoring systems	Ultrasonic recorders used to record bat calls
Torpor	A state of physical inactivity associated with lower body temperature and metabolism
SM_4BAT	Wildlife Acoustics' full spectrum ultrasonic bat monitoring recorder
$SMMU_2$	Wildlife Acoustics' ultrasonic microphones for recording bat sounds
Threshold	Bat activity threshold as provided by SABAA

HUGO WIND ENERGY FACILITY:

PRECONSTRUCTION SCOPING REPORT

This report serves as the Bat Specialist Assessment that was prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) for the proposed development of the Hugo Wind Energy Facility (WEF). Hugo Wind Energy Facility (WEF) is located west and east of the R318, the road between Montagu and De Doorns. It is situated within the Breede Valley and Langeberg Local Municipalities, Cape Winelands District Municipality of the Western Cape Province.

1. INTRODUCTION

Stephanie Dippenaar Consulting, trading as EkoVler, has been appointed to conduct a minimum of 12 months' bat study for the proposed Hugo Wind Energy Facility (WEF) by FE Hugo & Khoe (Pty) Ltd, South Africa. Bat monitoring started on 30 December 2022, when the Met mast was installed, and the latest data was collected on 12 August 2023.

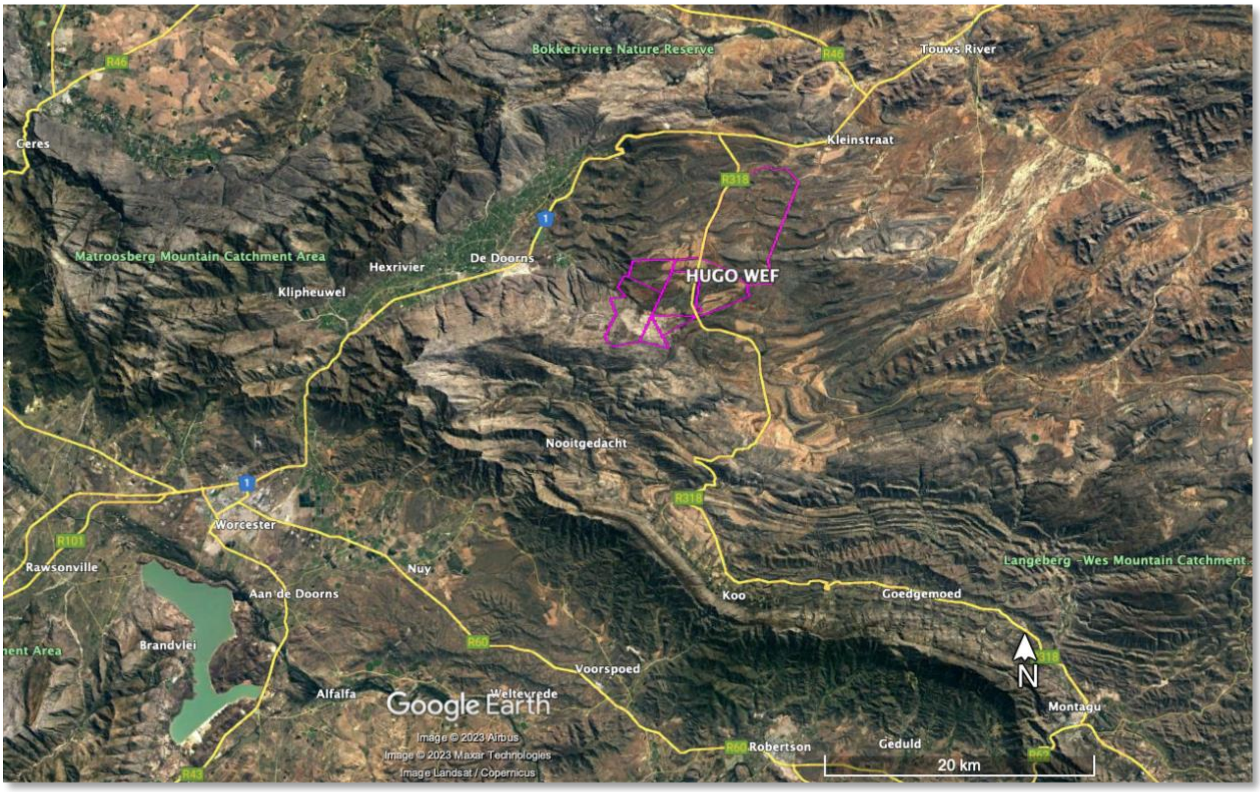

Figure 1: Locality map for the Hugo WEF (Google Earth).

This progress report comprises the following sections:

- *Section 1:* Introduction, which contains the Scope and Objectives, Details of the Specialist, and Terms of Reference.

- *Section 2*: Approach and Methodology, including all Information Sources, Assumptions, Knowledge Gaps and Limitations.
- *Section 3:* Description of Project Aspects Relevant to Bat Impacts, including Baseline Environmental Description, General Description, Project Specific Description, and Identification of Environmental Sensitivities.
- *Section 5*: Identification of Potential Risks/Impacts.
- *Section 6*: Results of the monitoring period up to now.
- *Section 7*: Preliminary bat sensitivity map.
- *Section 8*: Conclusion

The proposed wind farm following farm is situated on the following farm portions:

- RE/145 (Oudekraal)
- RE/147 (Stinkfonteins Berg)
- RE/172 (Stinkfontein)
- 0/173 (Driehoek)
- RE/174 (Presents Kraal)
- 9/148 (Helpmekaar)

This report provides an overview of the scoping exercise and progress of the bat monitoring programme at the Hugo Wind Energy Facility, hereafter referred to as Hugo WEF. More detailed statistical analysis of bat activity, such as results plotted against weather conditions, will be included in the final bat monitoring report.

1.1 Scope of the Work

This progress report is informed by the findings of a 12-month pre-construction bat monitoring programme, which documents the bat activity at the proposed Hugo WEF. The monitoring programme is conducted to collect information to assess the potential impacts on bats at the proposed wind farm.

This assessment forms part of an environmental assessment being undertaken by Environmental Resource Management (Pty)Ltd and will be conducted according to the Environmental Impact Assessment process in South Africa. The Scoping study presents the results from the bat activity monitoring programme, undertaken to date to predict the potential risk to the resident and migratory bats associated with the proposed development.

The study aims to present baseline information on bats that occur at the proposed Hugo WEF site to inform the mitigation strategies for the final design, construction, and operational phases. These mitigation strategies aim to avoid or reduce potential direct, indirect, and cumulative impacts associated with the proposed development. The primary impact on bats due to WEFs is fatality, due to bat collision with turbines or barotrauma. In addition, potential risks include habitat displacement and habitat loss during the Construction and Operational phases.

The objective of collecting and providing the baseline environmental information is to present the nature of potential impacts of the proposed project during the construction, operation and decommissioning phases, as well as the mitigation and enhancement measures to avoid or minimise potential impacts to bats.

As knowledge in this field of study is growing and new evidence is constantly gained from currently operating WEFs, mitigation and enhancement options may be adjusted as this project develops.

1.2 Details of Specialist

This specialist assessment has been undertaken by Stephanie Dippenaar Consulting trading as EkoVler. Stephanie has been registered with SAIES since 2002 and her SACNASP registration is in process, see Appendix 1.

Stephanie Dippenaar has a track record of involvement in environmental management since 1991, and in particular environmental assessments, since 2003. She has managed several renewable energy EIAs and has since 2010 started to specialise in bats. Stephanie has conducted 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. She is the owner of EkoVler and although the business officially only consists of one specialist, she has a good working relationship with several sub-contractors, see page 2 of this report for involvement in this study.

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.

1.3 Terms of Reference

The *South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities* (MacEwan, et al., 2020) guided the monitoring process. Based on these guidelines, acoustic monitoring of the echolocation calls of bats was used to determine the seasonal and diurnal activity patterns of bats at the proposed Hugo WEF. The following South African guideline documents were used in conjunction with the Pre-Construction Guidelines:

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

The following Terms of Reference are applicable to the monitoring exercise, as informed by the most current Pre-Construction Guidelines:

- Gathering information on bat species that inhabit the site, noting higher, medium, or lower risk species groups; as indicated in Table 4, p16, of the Guidelines (MacEwan, et al., 2020);
- Recording relative frequency of use by different species throughout the monitoring year;
- Monitoring spatial and temporal distribution of activity for different species;
- Identifying locations of roosts within and close to the site;
- Collecting details on how the surveys have been designed to determine presence of rarer species; and
- Describing the type of use of the site by bats; for example, their relative position from the turbine locations in terms of foraging, commuting, migrating, roosting, as can be observed through the monitoring data and site visits.

2. APPROACH AND METHODOLOGY

The methods for the investigation of bats at the proposed WEF development site are described below.

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

A desktop study was undertaken of the site, using the information provided by FE Hugo & Khoe (Pty) Ltd, as the developer, as well as information gathered through a literature review. The literature reviewed included existing reports and other studies for the area, as well as information from the SANBI GIS database. Conservation areas in the vicinity were investigated and information from other developments in the area, particularly renewable energy projects and wind farms, were noted 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 seasonal fieldwork sessions, physical surveys were conducted to identify the location of possible roosts. Interviews were also conducted with people staying on site or close to the site, to establish if they are aware of any roosts in the vicinity, or general bat occurrences.

2.2 Static Acoustic Monitoring

Static monitoring, using automated bat detector systems, provided invaluable data about the bats present on the site. The number of detectors required was calculated based on the surface area of the proposed site. Measurements were taken at various fixed locations and varying altitudes, as representative of the area in general and of each biotope present within the proposed study area (Figure 1). Static monitoring is essential in assessing the relative importance and temporal changes of features, locations, and potential migratory routes (MacEwan, et al., 2020). The monitoring systems deployed in the study area included six Wildlife Acoustics SM4BAT full spectrum bat detectors powered by 12V 7 Amp-h sealed lead acid batteries replenished by photovoltaic solar panels, see Table 1. Two SD memory cards, class 10 speed, with a capacity of 64GB each, or one 128GB were utilized in each detector to ensure substantial memory space with high-quality recordings, even under conditions of multiple false environmental triggers.

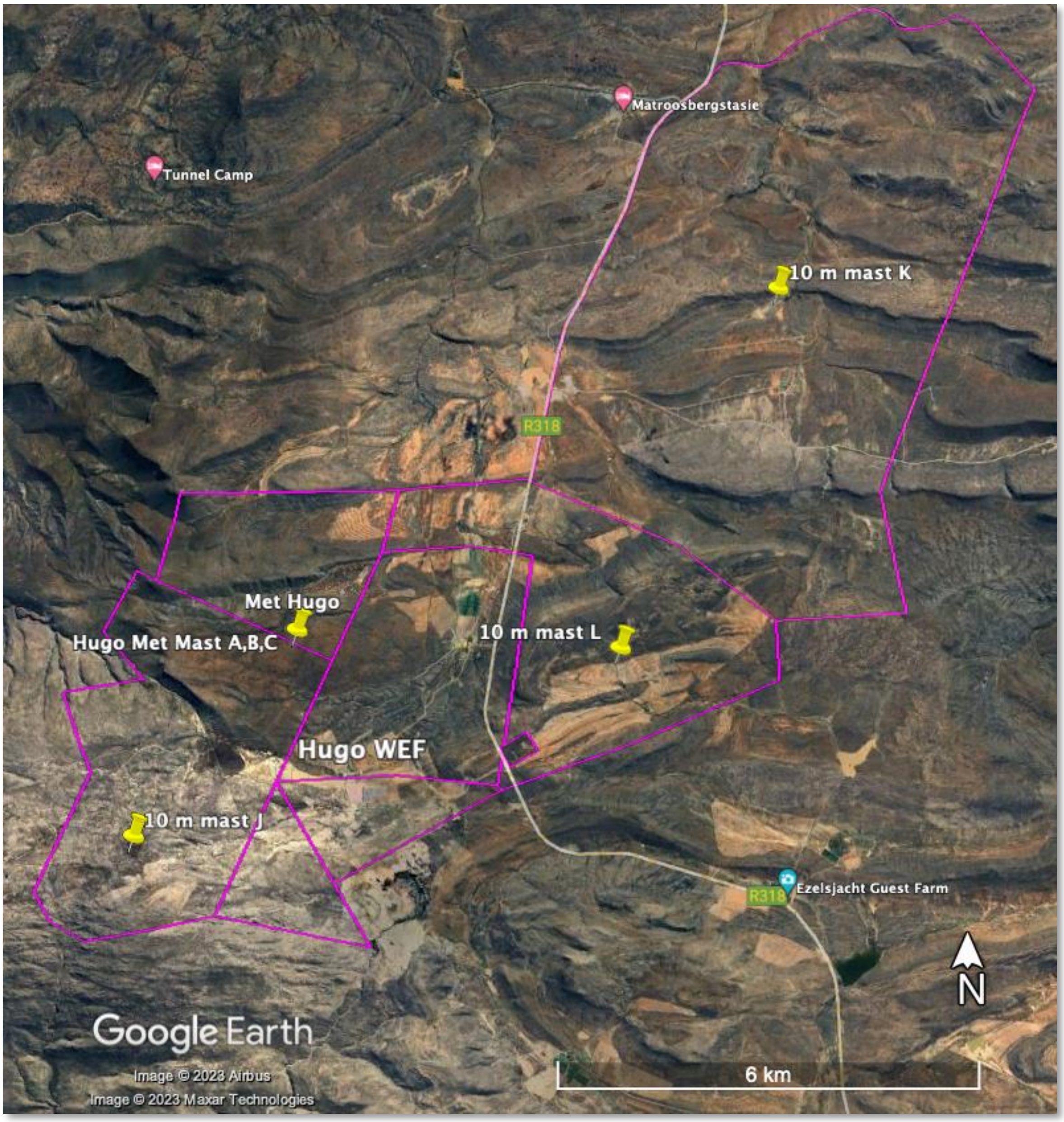

Figure 2: Position of bat monitoring systems.

Figure 3: System on a 10 m mast at the proposed Hugo WEF.

Figure 4: Monitoring systems on the met mast.

Figure 5: Example of mic on met mast.

Each detector was set to operate in continuous trigger mode from dusk each evening until dawn. Times were correlated with latitude and longitude, to trigger half an hour before sunset. The trigger mode setting for the bat detectors, which record frequencies exceeding 16kHz and -18dB, was set to record for the duration of the sound, and 1000 ms after the sound ceased. This period is known as the trigger window.

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.

Table 1: Summary of Passive Detectors deployed at the proposed Hugo WEF.

Detector	Position	Coordinates	Micro-phone	Division ratio	High pass filter	Gain	Format	Trigger window	Calibration (on chirp) when the mic was installed
SM4BAT (Met A)	Met mast: mic at 100 m	33º29’58,72” S 19º47’11,58” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-8,1 dB at the microphone
SM4BAT (Met B)	Met mast: mic at 50 m	33º29’58,72” S 19º47’11,58” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-7,7 dB at the microphone
SM4BAT (Met C)	Met mast: mic at 10 m	33º29’58,72” S 19º47’11,58” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-7,6 dB at the microphone
SM4BAT (Mast J)	Temporary mast: mic at 10 m	33º31’31,75” S 19º45’43,14” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-45,6 dB at 10 m
SM4BAT (Mast K)	Temporary mast: mic at 10 m	33º27’22,06” S 19º51’36,33” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-47 dB at 10 m
SM4BAT (Mast L)	Temporary mast: mic at 10 m	33º30’07,00” S 19º50’08,40” E	SMM-U2	8	16kHz	12 dB	FS, WAV@ 384 kHz	1 sec	-60 dB (10 m, in strong wind)

The position of the met mast was determined by the developer and the bat monitoring systems on the met mast represent the biotope associated with the undulating hills covered by Matjiesfontein Shale renosterveld (SANBI, 2012); However, the positions of temporary bat monitoring masts were selected, based on the representation of different biotopes, proximity to possible bat conducive areas, and accessibility to install a mast. Locations of the monitoring systems shown in Figure 1 are motivated as follow:

- *System J; 10 m Mast*: This monitoring system was placed on Matjiesfontein Sandstone Fynbos and is situated in a valley where turbine positions might most probably be placed if wind conditions are favourable. Numerous rock formations with roosting opportunities in deep crevices are found towards the east of this valley. Several termite heaps are found in the area which might attract bats during certain times of the year.
- *System K; 10 m Mast:* Originally this system was placed east of road 318, due to a large part of the site originally eliminated by bird buffers. When clarity was provided concerning bird buffers, the development area was larger than initially expected. During the second fieldwork session, in April 2023, Mast K was then shifted to the other side of the R318, to cover that area. The biotope was the same, but the new position renders the sampling point more representative. This mast was positioned close to two dames with nearby koppies and a wetland, with perennial water, in the valley.
- *System L; 10 m Mast:* Mast l represents the eastern side of the wind development, where cultivated fields and large areas of typical renosterveld occur. The system was placed close to a non-perennial ditch of stone, where natural ponds fill with water during the rainfall season.

The location of the monitoring systems is shown in Figure 2, and the monitoring equipment on the met mast is depicted in Figures 3, 4 and 5.

2.3 Roost Surveys

Roost surveys were conducted when the bat specialist visited the site. While areas where possible roosts could be situated, were investigated, all roosting areas are not accessible as bats sometimes roost in crevices or roofs with limited ceiling space. When day roosts are 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 is large and roost searches are concentrated in areas where one would expect bats to roost. Within the 12 months and limitations of the bat monitoring study, some bat roosts might not be discovered. Up to now, no roosts have been discovered, but summer searches, when bats are most active, have not been conducted yet.

2.4 Manual Surveys – Driven Transects

Less emphasis is placed on transects in the current guidelines, while more focus is placed on point sources. Manual activity surveys, such as driven transects, could provide additional spatial understanding of the bat species utilising the site. This is especially the case for the identification of key features, potential commuting routes, and overall activity within and surrounding the site. Transects complement static monitoring surveys in terms of spatial coverage. No transects have been performed during the scoping phase, but transects will be conducted in the upcoming summer season.

A SM4BAT full spectrum recorder with the microphone mounted on a pole is used for transects. 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. As far as possible, transect routes were kept the same to allow for the comparison of data.

2.5 Point Sources

A SM4BAT full spectrum recorder is used during point sources, where the detector is placed for one night at a place where there is expected to be optimum bat activity. In April a detector was placed next to a farm dam, close to the Ratelbosch (Nadini) dwellings. Up to now weather was quite cold during site visits. Bats are more active during warmer weather and more point source recordings will be conducted during the summer of 2023 and 2024.

2.6 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 bat activity 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.

2.7 Information Sources

The following information sources were used to inform this study:

- 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.

Maps:

- **Vegetation**

  South African National Biodiversity Institute (2006-2018). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online, http://bgis.sanbi.org/Projects/Detail/186, Version 2018.

- **Land Cover**

  9-class (DEA, 2020) -Department of Environmental Affairs

- **Water Resources**

  National Geo-spatial Information (DRDLR)

- **Conservation**

  CapeNature

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:

- Regular personal conversations were conducted with the landowners of the proposed WEF site during fieldwork sessions, 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.

2.8 Assumptions, Knowledge, Gaps 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 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 was 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 the long-term spatial distribution of bat activity across the project site. However, transects are useful in eliciting areas or 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. BASELINE ENVIRONMENTAL DESCRIPTION

The Hugo WEF site is located on farmland southeast of De Doorns and southwest of Touws River, in the Western Cape Province. The centre coordinates of the proposed wind farm site are 33°29'39.83" S and 19°47'09.82" E. The project is in close proximity to the Hexrivier valley; however, the Hugo farm itself is situated on a plateau, which then descends into the Karoo, towards the east and beyond the Hugo development. The terrain is a combination of flatter surfaces, towards the middle section of the farm, while the south-western and north-eastern area is made up of more mountainous terrain.

3.1 General Description of the area

3.1.1 Climate

The proposed Hugo WEF is situated on a plateau, which is sometimes called the “Agterveld”. Most of the precipitation occurs in winter with a second rainfall that is often experienced from October to December. Seasonal snow usually occurs during winter.

Long-term climate data from the Matroosberg weather station, also situated on the plateau, is used for a general climate description for the Hugo WEF. Generally, January and September are the driest months, with an average of 14 mm of rainfall. April, with an average rainfall of 35 mm, is the peak rainfall month, see Figure 4. There is a difference of approximately 21 mm between the wettest and driest months (meteoblue.com, 2023).

The average maximum temperature is 29^{o}C and the average minimum temperature 4^{o}C, while the highest maximum recorded temperature is 36^{o}C, and the lowest minimum is 0^{o}C. The hottest months of the year are January and February, while the coldest month of the year is July (meteoblue.com, 2023). Bat activity is expected to be higher during months that display relatively higher temperatures, with lower wind speeds.

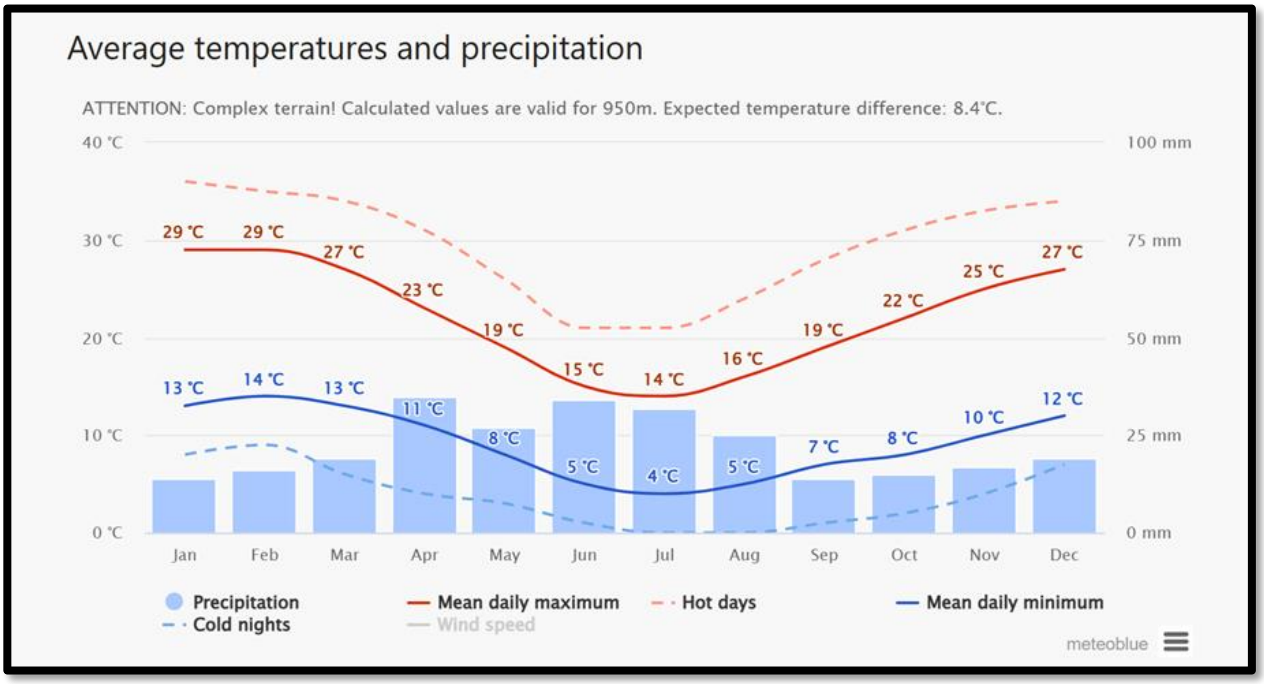

Figure 6: Climate of the Matroosberg weather station (meteoblue.com, 2023)

3.1.2 Vegetation

The proposed study area falls within the Fynbos Biome, with the following main vegetation types being represented on site: Matjiesfontein Quartzite Fynbos, Matjiesfontein Shale Renosterveld, North Langeberg Sandstone Fynbos and a small section of South Langeberg Sandstone Fynbos, as portrayed in Figure 7 (SANBI, 2018). Fynbos, which has a high species diversity, typically grows in soil that is nutrient-poor.

While approximately only 85 000 km^2, or 6.7%, of South Africa's surface area is covered by Fynbos, this biome has the highest species diversity (around 7500 species) in South Africa (van Wyk, 2001; UWC, 2022). The Fynbos biome is mostly limited to the Cape Floristic Kingdom, occurring in a typically cool winter rainfall area. This biome is in general considered 'high' in red data conservation species.

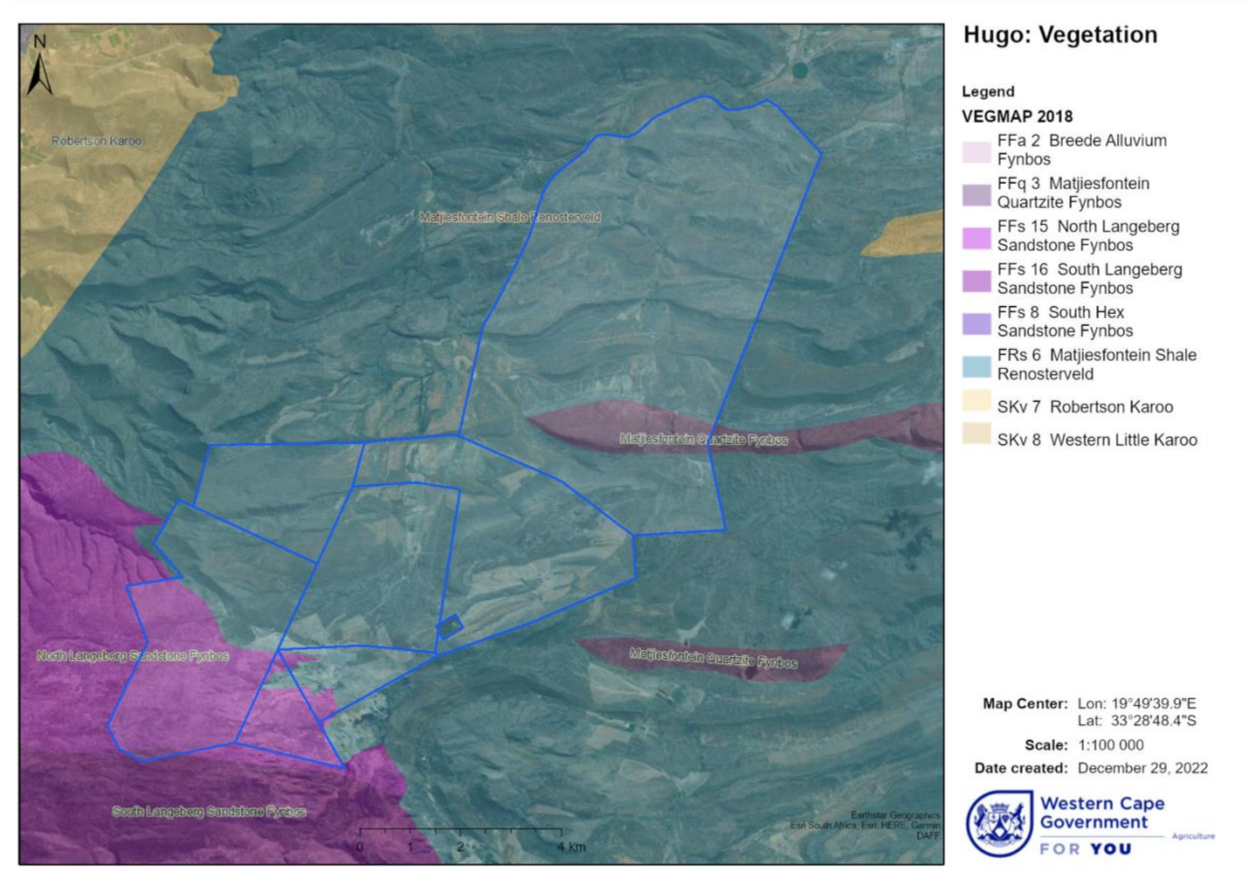

Figure 7: Hugo WEF Vegetation Zones (SANBI, 2018).

3.1.3 Conservation Areas

The proposed Hugo WEF is surrounded by several protected areas, see Figure 8. The nearest registered reserve, the Bokkeriviere Nature Reserve's southern border, situated in a northly direction from the Hugo WEF, is situated less than 5 km from the northern border of the proposed terrain. In addition, the Hugo WEF overlaps with the Matroosberg Mountain Catchment Area, which stretches towards a southwesterly direction beyond the Hugo WEF; while another Mountain Catchment Area, namely the Langeberg-Wes Mountain Catchment Area, is located on the southeasterly side of the WEF. The Koue Bokkeveld Mountain Catchment Area is situated further away in a northwesterly direction.

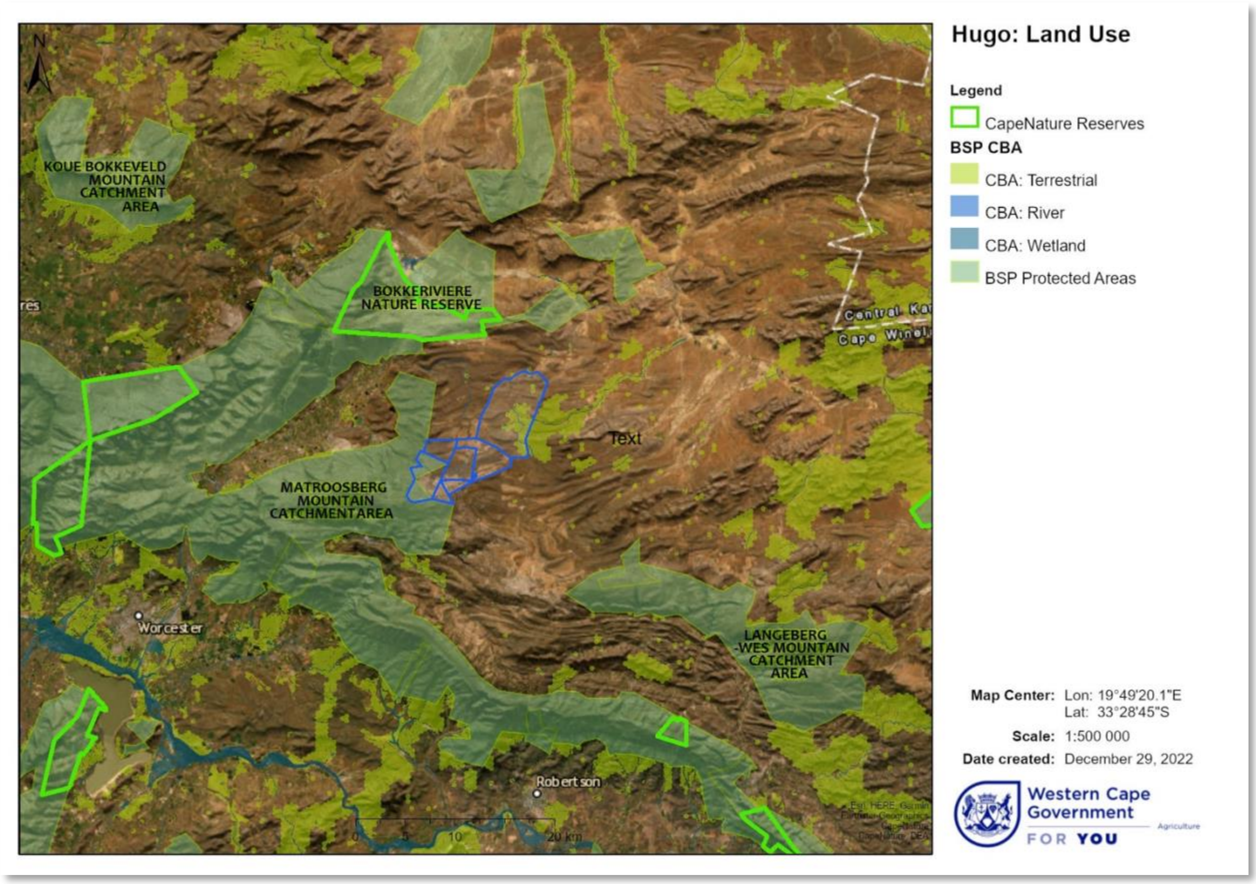

Figure 8: Protected areas in the vicinity of Hugo WEF (CapeNature, 2022).

3.1.4 Land use

The town of De Doorns is located northwest of the proposed wind farm site, in the Hex River Valley, which is a flourishing viticulture area.

The proposed Hugo WEF, on the other hand, is situated on a plateau before one descends to the Karoo, and although it is also in the winter rainfall region, the land use differs from the De Doorns area. Although some onion seed cultivation and greenhouses do occur, the main agricultural activities are livestock and wheat farming, as depicted in Figure 9 below.

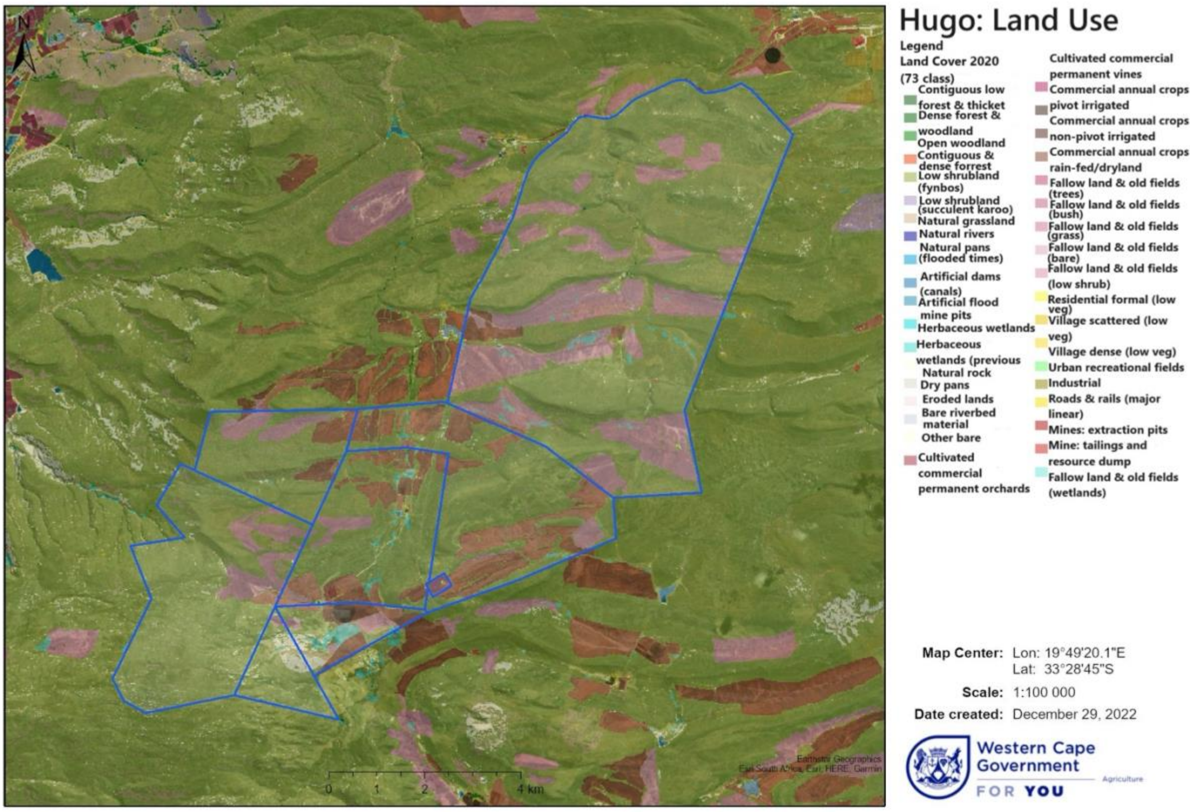

Figure 9: Land use in the Hugo WEF study area (DEA, 2022).

3.1.5 ***Water resources***

There are numerous dry water courses and non-perennial water bodies in the area and throughout the Hugo WEF. However, there is a slightly higher presence of non-perennial water bodies in the northerly region of the site compared to the south, see Figure 10. During rainy spells, water collects in these non-perennial ditches, depressions, and farm dams. Not only could these temporary open water sources provide water for bats to drink, but stagnant water could be a breeding ground for insects, which in turn attracts bats.

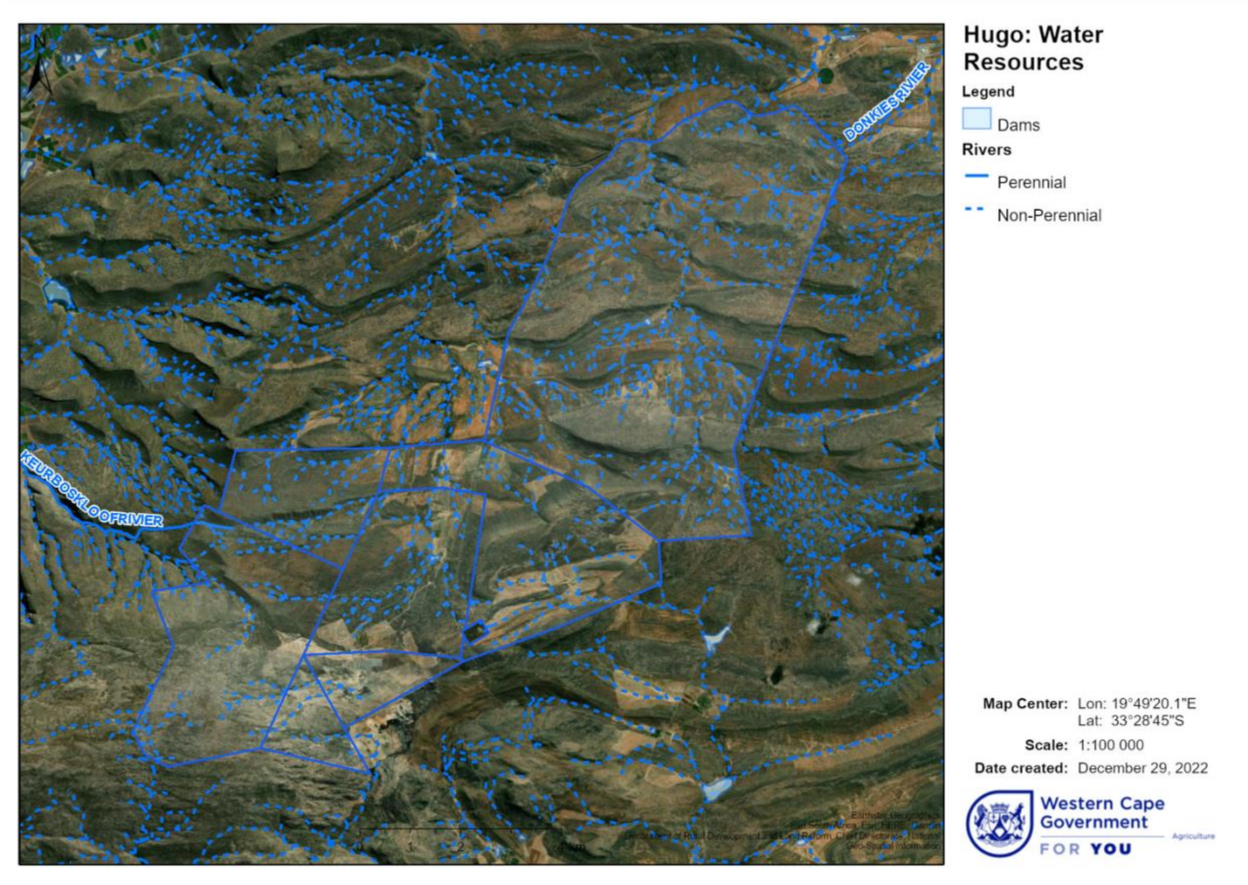

Figure 10: Water resources (DRDLR, 2022).

3.2 Features related to bats at the Hugo WEF

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

3.2.1 Vegetation

Figure 11 and 12 depicts vegetation typical of the type of fynbos situated in the area. However, there are relative denser bushes situated in the non-perennial riverbeds and limited trees near houses which could provide roosting opportunities for bats that prefer roosting in vegetation or under the bark of trees.

Figure 11: Typical Matjiesfontein Shale Renosterveld.

Figure 12: North Langeberg Sandstone Fynbos in the South east, with rock formations towards the east.

3.2.2 Rock formations rock faces and animal burrows

Rock formations along the hilltops, and along the river valleys provide ample roosting opportunities for bats. The south eastern border of the site, presents particularly numerous roosting opportunities in the rocky outcrops, see Figure 13. Also, the Matroosberge are bordering and stretching beyond the western part of the proposed site and bats from these neighbouring regions, could traverse the proposed wind farm to forage, drink water or migrate.

Abandoned aardvark holes, as displayed in Figure 14, could also present a roosting opportunity for bats.

Figure 13: Rock formations in the eastern section of the site which could provide possible roosting opportunities for bats.

Figure 14: An example of an Aardvark hole, a bat roosting opportunity.

3.2.3 Human dwellings and building structures

Where roofs are not sealed off, human dwellings could provide roosting space for some bat species. Up to now, no evidence of bat roosts has been found at the farm dwellings, but this is an ongoing study. There are still farm dwellings to investigate and further roost investigations will be conducted during late spring and summer.

3.2.4 Open water and food sources

During spells of rain, stagnant water that collects in small pans and dry ditches could serve as breeding grounds for insects which could serve as food for bats, see Figure 15. High insect activity results in higher bat presence after sporadic rainy periods. Open dams provide permanent, open water sources for bats throughout the year, see Figure 16. Termites are an important food source for bats, and several termite heaps have been observed at Hugo WEF, see Figure 17.

Figure 15: Typical Matjiesfontein Shale Renosterveld with bedrock collecting water in the non-perennial riverbed.

Figure 16: Open water source at the proposed Hugo WEF.

Figure 17: An example of a termite heap, a bat roosting opportunity.

3.2.5 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 Hugo 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. Table 2 is informed by the most recent distribution maps of Monadjem, et al. (2010 and 2020). This information 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 in South Africa and one Vulnerable, while three have a global conservation status of Near Threatened. *Eptesicus hottentotus* (the Long-tailed serotine) and *Cistugo seabrae* (the Angolan wing-gland bat) are endemic to Southern Africa and have limited suitable habitat left, mainly due to agricultural activities (Monadjem, et al., 2010).

According to the likelihood of fatality risk, as indicated by the latest pre-construction guidelines (MacEwan, 2020) four species, namely *M. 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. *Myotis tricolor* (Temminck's myotis bat), and two fruit bat species, *Eidolon helvum* (African straw-coloured fruit bat) and Rousettus *aegyptiacus* (Egyptian rousette) have a medium to high risk of fatality while *E. hottentotus* has a medium risk of fatality.

The two Pteropodidae species (fruit bats) are not expected to roost on the project site itself, as this environment is not expected to be their preferred habitat; however, the proximity of the mountains around the site, the agricultural activities of the Hexrivier valley situated in the north-westerly direction and the presence of water sources in the area, might attract fruit bats if they migrate over the area and the possibility that they could sporadically occur at the development area should not be ruled out.

Table 2: Potential bat species occurrence at the proposed Hugo WEF site. Information about the species is from Monadjem, et al. (2010 and 2020).

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 the surrounding area	Bats recorded at the Hugo project site
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.	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.	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 flit-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		
MOLISSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Least Concern	Least Concern	Roofs of houses, caves, rock crevices, under exfoliating rocks, hollow trees	Open-air, insectivorous	Not known	High	✓	✓
	Sauromys petrophilus	Robert's Flat-faced	Least Concern	Least Concern	Narrow cracks, under exfoliating of rocks, crevices.	Open-air, insectivorous		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 the surrounding area	Bats recorded at the Hugo project site
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	✓	
VESPER-TILIONIDAE	*Neoromicia capensis (Laephotis capensis)*	Cape serotine bat (Cape roof bat)	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		
	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., 2020b).*

***Neoromicia capensis has been reclassified as Laephotis capensis* (Cape roof bat)

3.3 Project Specific Description

FE Hugo & Khoe (Pty) Ltd proposes to construct the Hugo wind Energy Facility and the associated infrastructure, with a capacity of up to 250 MW WEF. Apart from a preliminary layout, see Figure 18, no other project information has been received yet. More project details will be provided in the final report.

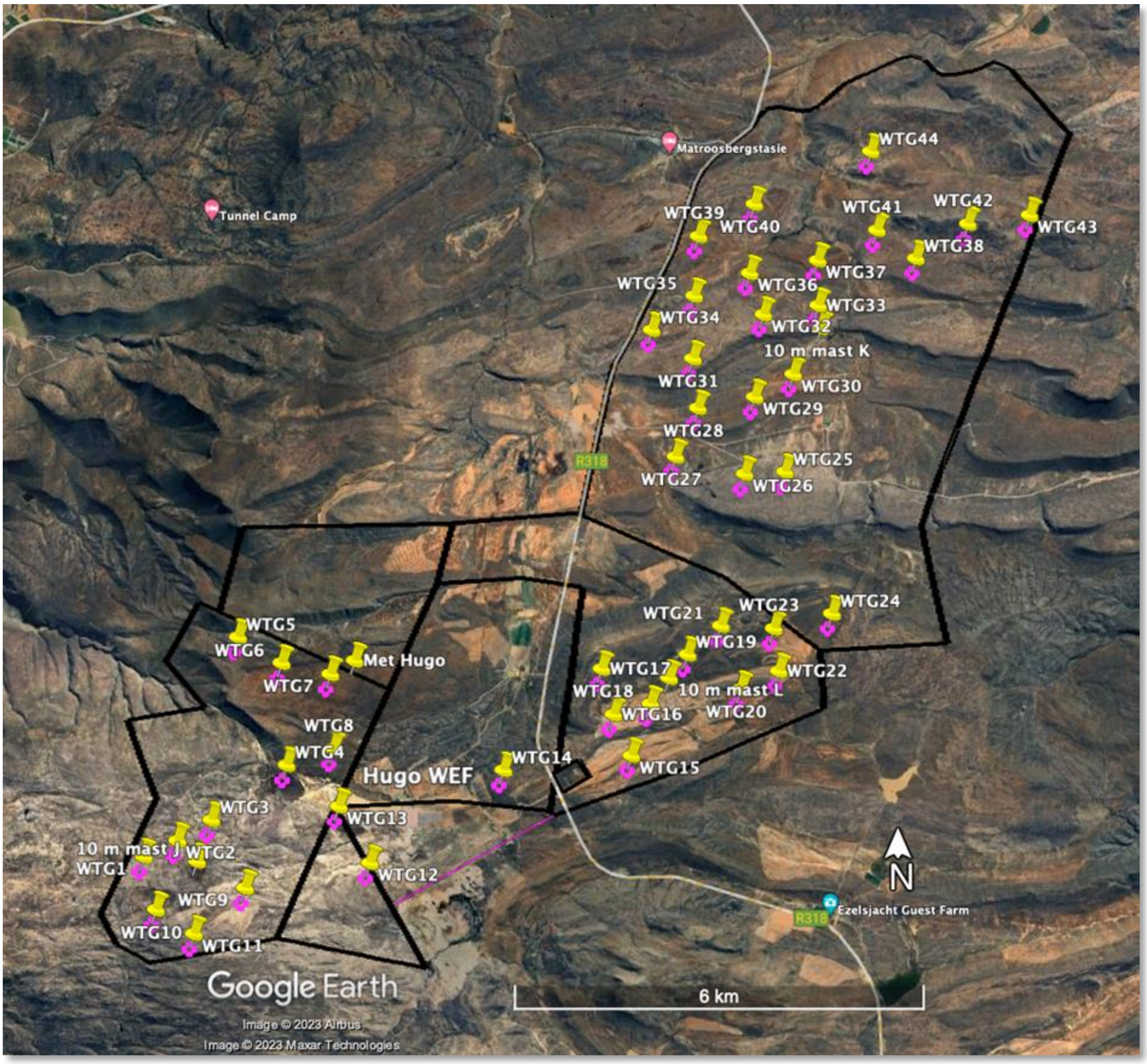

Figure 18: Preliminary Turbine Layout at the proposed Hugo WEF site.

4. ISSUES, RISKS, AND IMPACTS

4.1 Identification of Potential Impacts/Risks

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

The potential impacts on bats could be summarised as follow:

- Removal of limited roosting space on-site, such as rock formations or trees;
- Mortality during the operation of wind turbines;
- Habitat loss due to the operational wind farm;
- Change in foraging potential;
- Create new bat conducive habitat amongst the turbines; and
- The cumulative effect of the above together with the surrounding wind farms.

4.2 No-go Option

If the development does not progress, the status quo is expected to prevail, and no negative impact is expected.

The ideal, when 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 potential collision.

The potential impacts identified at this stage of the bat monitoring include:

4.3 Construction Phase

1. Roost disturbance, destruction and fragmentation due to construction activities;
2. Creating new habitats amongst the turbines, such as buildings, excavations, or quarries; and
3. Disturbance to bats during the construction activities during night-time.

4.4 Operational Phase

4. Mortality due to direct collision or barotrauma of resident bats;
5. Mortality due to direct collision or barotrauma of migrating bats;
6. Loss of bats of conservation value;
7. The attraction of bats to wind turbines;
8. Loss of habitat and foraging space; and
9. Reduction in the size, genetic diversity, resilience, and persistence of bat populations.

4.4 Decommissioning Phase

10. Disturbance due to decommissioning activities.

4.5 Cumulative impacts of wind farms within the surrounding areas

11. Cumulative effect of construction activities of several wind farms within 30 km from the proposed Hugo WEF site;
12. Cumulative resident bat mortality of all the wind farms;
13. Cumulative bat mortality of migrating bats;
14. Cumulative loss of bats of conservation value;
15. Cumulative effect of habitat loss over several thousand hectares of all wind farms; and
16. Cumulative reduction in the size, genetic diversity, resilience, and persistence of bat populations.

5. RESULTS OF BAT MONITORING AT HUGO WEF

5.1 Static recorders

Passive monitoring data for the period between 30 December 2022 and 12 August 2023 is included in this progress report. The systems on the met mast were installed end of December, while the other systems at Hugo were installed beginning March 2023. 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.

Due to a heavy rainfall spell and issues with the accessibility of the system, gaps are present at System J, see Table 3, between 12 February 2023 to 18 March 2023, and 20 June 2023 to 12 August. Although the ideal is that all systems are operational all the time, this biotope is also covered by the systems on the met mast and there is enough data to provide an informed decision regarding the bat situation on site.

Table 3: Table showing periods of monitoring data with the gaps in data.

Available Data	Gaps
30 Dec 2022 - 11 Feb 2023	None
12 Feb 2023 - 23 Apr 2023	10m Mast (J): 12 Feb 2023 - 18 Mar 2023
24 Apr 2023 - 12 Aug 2023	10m Mast (J): 20 Jun 2023 - 12 Aug 2023

5.1.1 Bat Species Diversity

Calls like five of the 12 species that have distribution ranges overlaying the proposed development site were recorded by the static recorders (Table 2 and Figure 18). Bats can be divided into groups, based on their preferred foraging altitudes. They are adapted, mostly by the physiology of their wings, to forage at a range of altitudes, namely lower altitudes (clutter) amongst bushes and trees, on the edge of relative higher density vegetation (clutter-edge), and open-air (high-flying bats). 63% of the calls were from *Neoromicia capensis (Laephotis capensis)*, which is the dominant species on site. The second highest percentage of calls were from *Tadarida aegyptiaca* (28%), which is physiologically adapted to flying high and is thus a species at high risk of collision with turbine blades as well as barotrauma. 7% of the activity recorded was from the global as well as regional Near Threatened *Miniopterus natalensis,* 1% from *Sauromys petrophilus* and 1% from the endemic *Eptesicus hottentotus*.

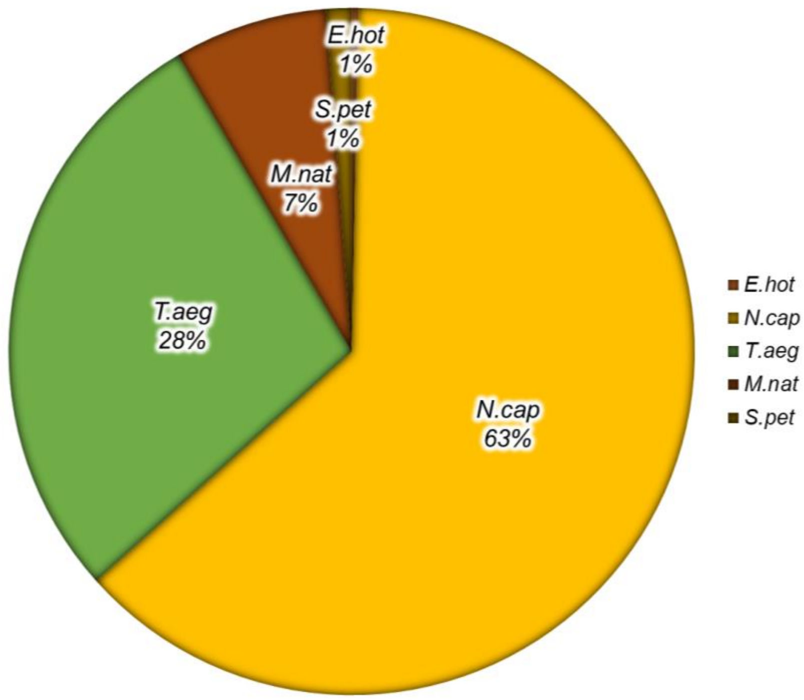

Figure 19: Overall bat species diversity at Hugo WEF.

N. capensis of the Vespertillionidae family and *T. aegyptiaca* of the Molossidae family are the most dominant bats on site. Both these species are falling within the high-risk fatality category (see Table 2). y The majority of the recorded bat activity (99%) at the Hugo WEF site is expected to be at risk of fatality during the operational lifespan of the turbines.

Species diversity is often higher at lower altitudes, which is also the case at Hugo WEF and demonstrated in Figure 18, which depicts the species recorded at each monitoring system. System A, at 100 m on the met mast, recorded 95% *T. aegyptiaca,* while the 50 m system (B) on the met mast, recorded 97% of this species. The second highest percentage of calls were made by *S. petrophilus*, respectively 5% and 3% at these two systems. Not much of a difference in species diversity has been observed between the 100 m system and the 50 m system. In total, nearly 100% of the bats recorded at these two systems belong to the two Molossidae species, *T.aegyptiaca* and *S. petrophilus*. Both these species are at high risk of fatality.

The expected difference in species diversity between high altitude and lower altitude systems is seen when the data from 100 m and 50 m sampling points are compared to the data from the 10 m systems. A much higher percentage of *N.capensis* was recorded at the four 10 m systems. The species diversity was found to be more or less similar at the lower met system C, 10 m Mast J and 10 m Mast K. The met low system (C) recorded 60% *N. capensis,* 31% *T. aegyptiaca*, 6% *M. natalensis*, 2% *S.petrophilus* and 1% *E. hottentotus.* The 10 Mast systems (J and K), situated in a valley, recorded 72% and 61% of *N.capensis* respectively, 20% and 29% of *T.aegyptiaca* respectively, 7% and 8% of *M. natalensis* respectively, 1% of *S. petrophilus* for both systems, in addition to an insignificant amount and 1% of *E. hottentotus* respectively. When comparing the 10 m Mast L to all the other systems, the activity from *N.capensis* (82%) as well as the activity from *M.natalensis* (10%) were found to be the highest at this system, while

T. aegyptiaca (20%) portray the lowest activity. Furthermore, a statistically insignificant number of *S. petrophilus* and *E. hottentotus* were recorded at system L.

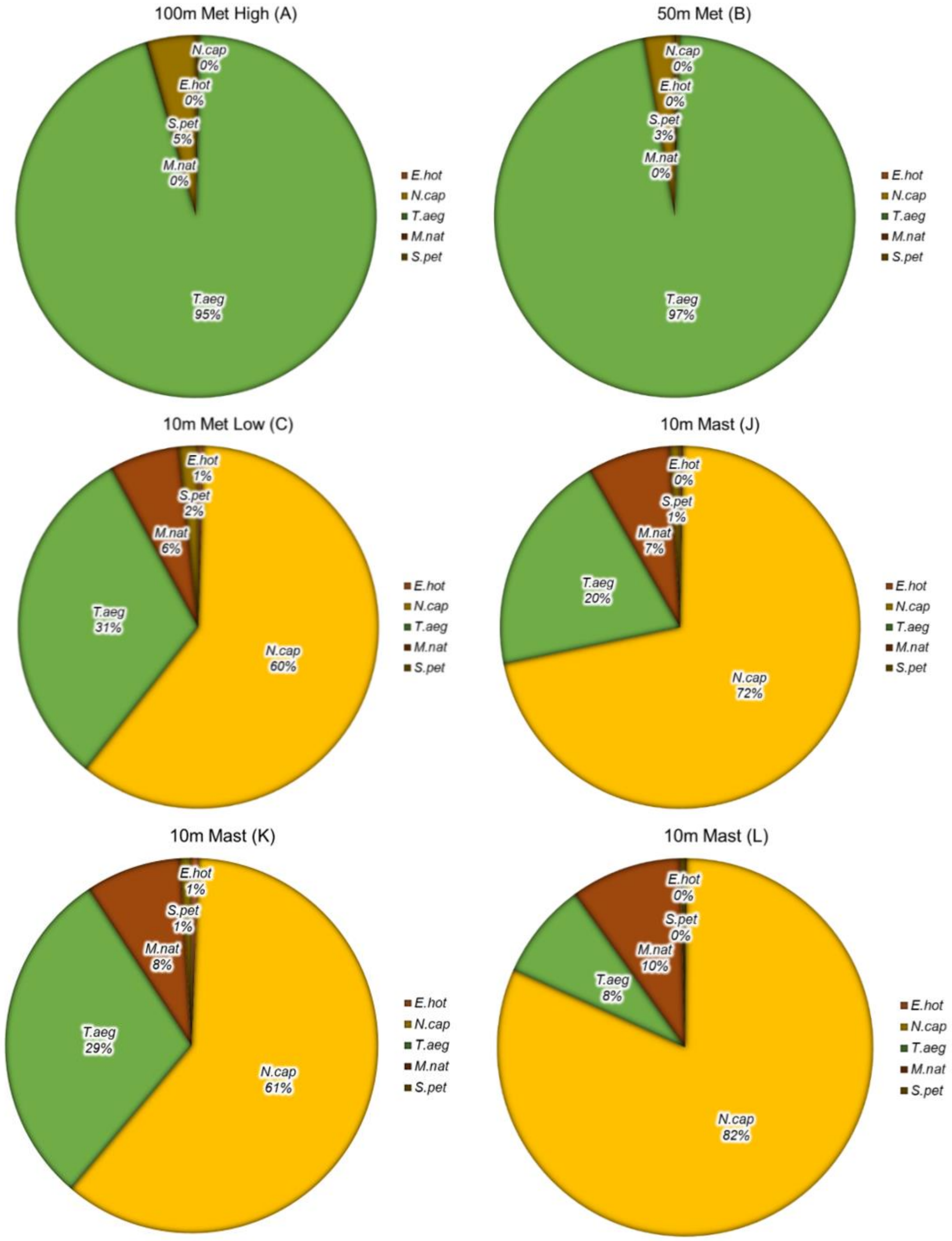

Figure 20: Species diversity at each monitoring site.

5.1.2 Temporal distribution of bat passes over the monitoring period

Figure 21 indicates the weekly temporal distribution of bat passes over the monitoring period. The grey and blue bars in the histogram depict higher activity, indicating the relatively higher occurrence of *Neoromicia capensis* and *Tadarida aegyptiaca* respectively during the monitoring period. Relatively higher than normal activity at the proposed Hugo site was also observed by *Miniopterus natalensis* and is depicted by the orange bar in the histogram.

As mentioned above, all systems were operational by March. One can observe higher activity during the warmer, autumn months from March to May 2023, with notably high activity by *N. capensis (L. capensis).* Also, worthy to note, is the relatively higher activity at this site by *M. natalensis* from March 2023 up until the end of May 2023. Low activity was recorded between June and August during the colder months.

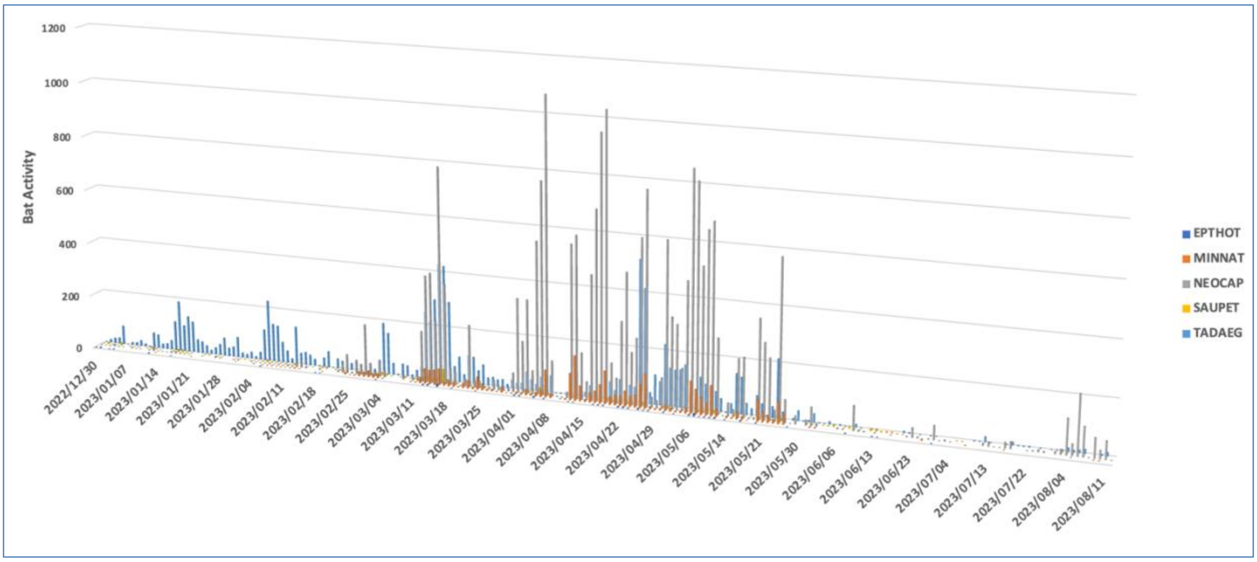

Figure 21: Temporal distribution of bat passes over the monitoring period.

5.1.3 Species distribution and activity per monitoring station

The difference in species recorded at the various systems can be observed in Figure 22. This provides a picture of species diversity and activity that were recorded at the various systems and as a result, one could compare the total bat activity recorded from different systems at various altitudes and biotopes. *N. capensis* portrays the highest recorded activity and was significantly more active at the 10m masts with a near absence at 100 m (A) and 50 m (B), situated on the met mast. *T. aegyptiaca* portrayed the second-highest activity for the monitoring period and although this bat is widespread at the site, higher activity was recorded at 100 m (A) and 50 m (B). The highest activity of the Near Threatened *M. natalensis* was recorded at the 10 m mast L, situated near the centre of the site.

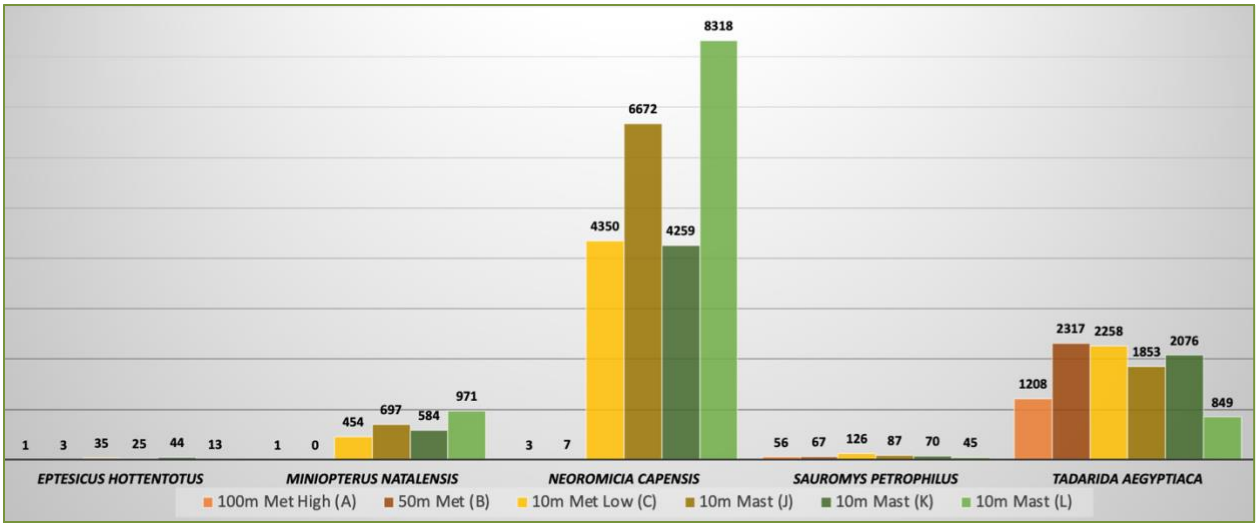

Figure 22: Species and activity per monitoring station.

5.1.4 ***Hourly bat passes per night***

The total number of nightly bat passes per hour for the monitoring period is shown in Figure 23. These figures provide insight into the general distribution of bat activity during each night, from sunset to sunrise. Activity across all the systems increases at sunset, with a gradual incline in activity about an hour after sunset. Most systems peak in activity at approximately an hour after sunset (10 m Mast G) to approximately two hours after sunset (100 m Mast A, 50m Met B, 10 m Mast C, 10m Masts J, K, L). In general, a very peculiar pattern of high activity around sunset, with a gradual decline by the hour towards sunrise is seen. Bats at Hugo WEF seem to remain active up to the early morning hours when they return to their roosts before sunrise.

Figure 23 incorporates data for the monitoring period to date. The data shows a general trend, as sunset and sunrise shift with the seasons. These patterns are of importance if mitigation measures are to be developed, as they indicate the most active periods during the night, but more refined monthly data will be taken into consideration if a mitigation programme is developed.

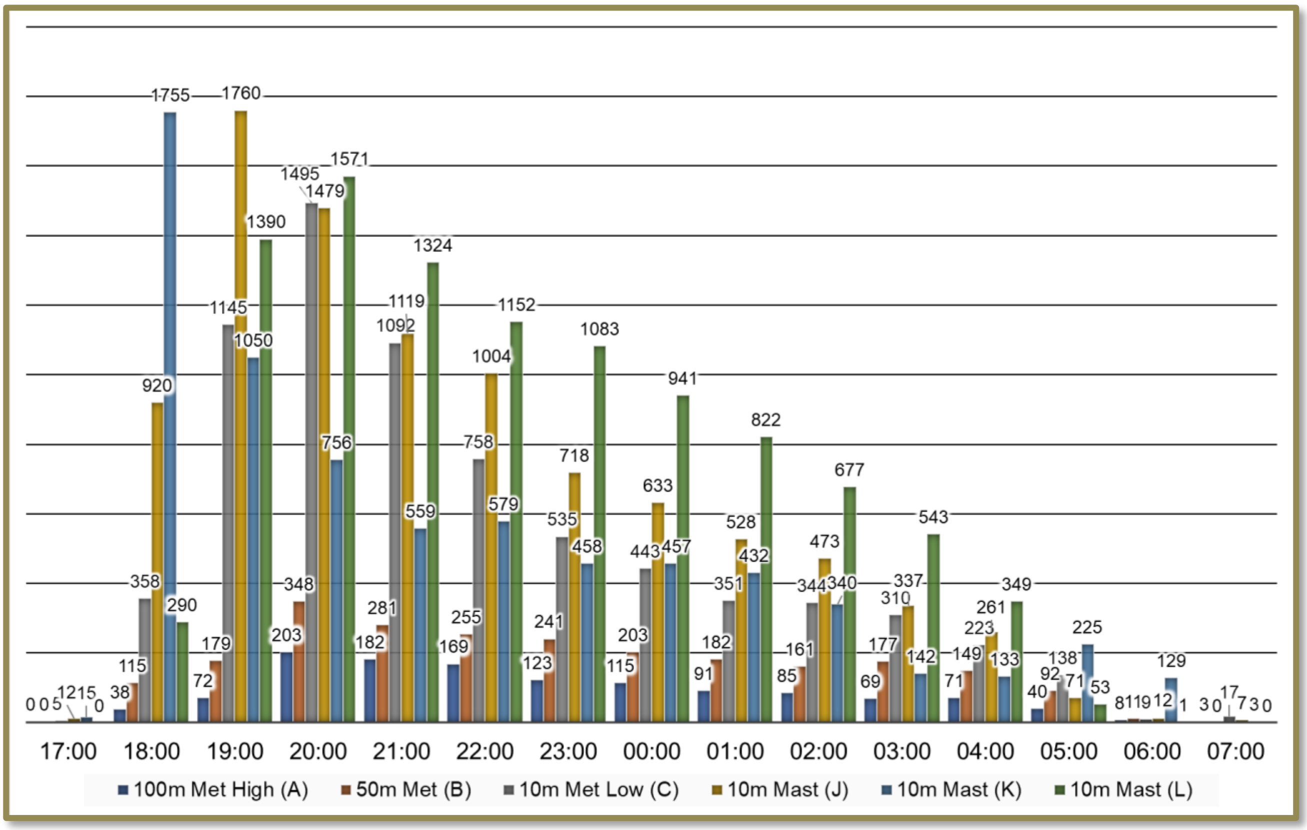

Figure 23: Total hourly nightly bat passes.

5.1.5 ***Average monthly bat activity***

The total monthly bat activity is portrayed in Figure 24. This histogram clearly indicates the increased activity during the autumn months if compared to activity during the winter months. A sharp monthly increase in activity can be observed from March to April and May, with peak in activity during April. From then onwards, a sudden drop in activity is observed in June, with low activity up to August. It is predicted that increased activity will be experienced towards September, as warmer weather sets in, with a further increase towards the summer months, but one will only be able to confirm this when more data is available.

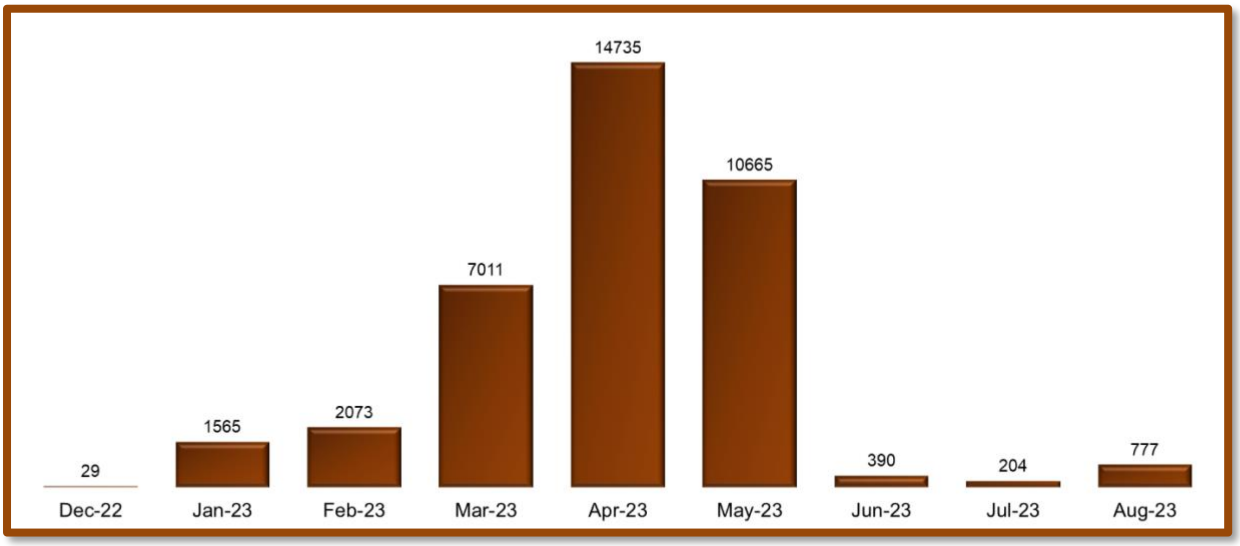

Figure 24: Total monthly bat activity.

5.1.6 Median bat activity of each monitoring system

Figure 25 indicates the median hourly bat activity for each monitoring station. By using medians, the activity of monitoring systems can be compared, even when recording days were missed. Although the species diversity, Section 5.1.1, was quite similar when comparing the 100 m (A) and 50 m (B) systems, the difference in bat activity between 100 m and 50 m, when compared, can be seen, with higher activity recorded at 50 m. There seems to be a decline in activity with increased altitude at the met mast, with System A, situated at 100 m, portraying lower activity when compared to System B, at 50 m, while System C, situated at 10 m portrays the highest activity on the met mast. The four 10 m systems (C, J, K and L) all recorded higher activity than the two systems at height (A and B).

The difference between 10 m Systems K and L is minimal, with System C, on the met mast, indicating the lowest activity and System J, the highest activity when comparing the 10 m systems. It should be noted that there were failures at System J, so this data was extrapolated and due to the large data gaps, is not trustworthy until more data has been collected.

Extra care is taken with activity at Systems A and B, as these systems are situated within the sweep of the turbine blades with high activity from *T. aegyptiaca.* If present data of operational wind farms are considered, this species has the highest risk of fatality. The final report will provide a more complete picture of the whole monitoring period, indicating possible mitigation measures to curb predicted bat activity, if necessary

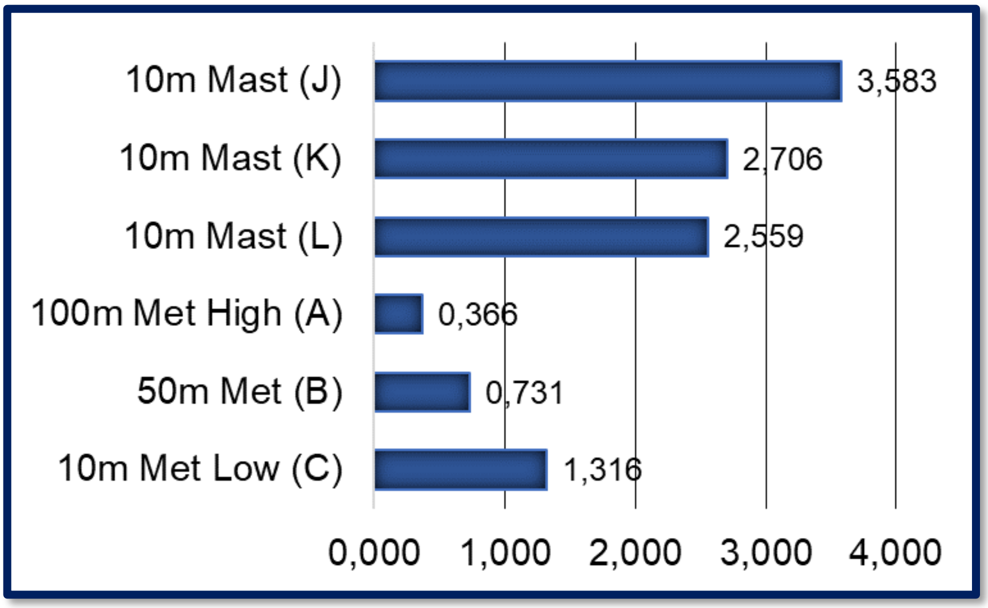

Figure 25: Median of hourly bat activity per system.

6. PRELIMINARY BAT SENSITIVITY MAP

Figure 26 depicts the preliminary bat sensitivity map. The bat sensitivity zones still need to be refined, incorporating data from the whole monitoring year. Correlations between bat data and weather conditions will be included in the final bat monitoring report. Therefore, there will be some changes in sensitivity zones.

At present, only high-sensitivity zones are identified on the sensitivity map. It is recommended that high-sensitivity zones are avoided for all moving turbine components. This includes the tips of turbine blades. Components of supporting infrastructure might occur in these areas, such as roads, grid connections, sub-stations and office buildings, as long as no bat roosts are disturbed during construction. Guidelines to avoid roost destruction will form part of the EMPr. The following are included in high-sensitivity zones at Hugo WEF with buffers as prescribed by the SABAA guidelines (MacEwan, et al, 2020):

- Clumps of trees which could serve as roosts – 200 m buffer;
- Watercourses. Non-perennial watercourses will have water during rainy spells and standing water which collects in the ditches is an important feature contributing to increased bat activity – 200 m buffer from the side of the water courses;
- Rock formations, rocky outcrops and features which are conducive to bat roosts – 200 m buffer; and
- Human dwellings – 500 m buffer.

The final bat sensitivity map can only be compiled when bat indexes, with data from all seasons, have been calculated. Mitigation measures will be recommended in the final bat impact assessment report after correlations between weather and bat activity have been conducted.

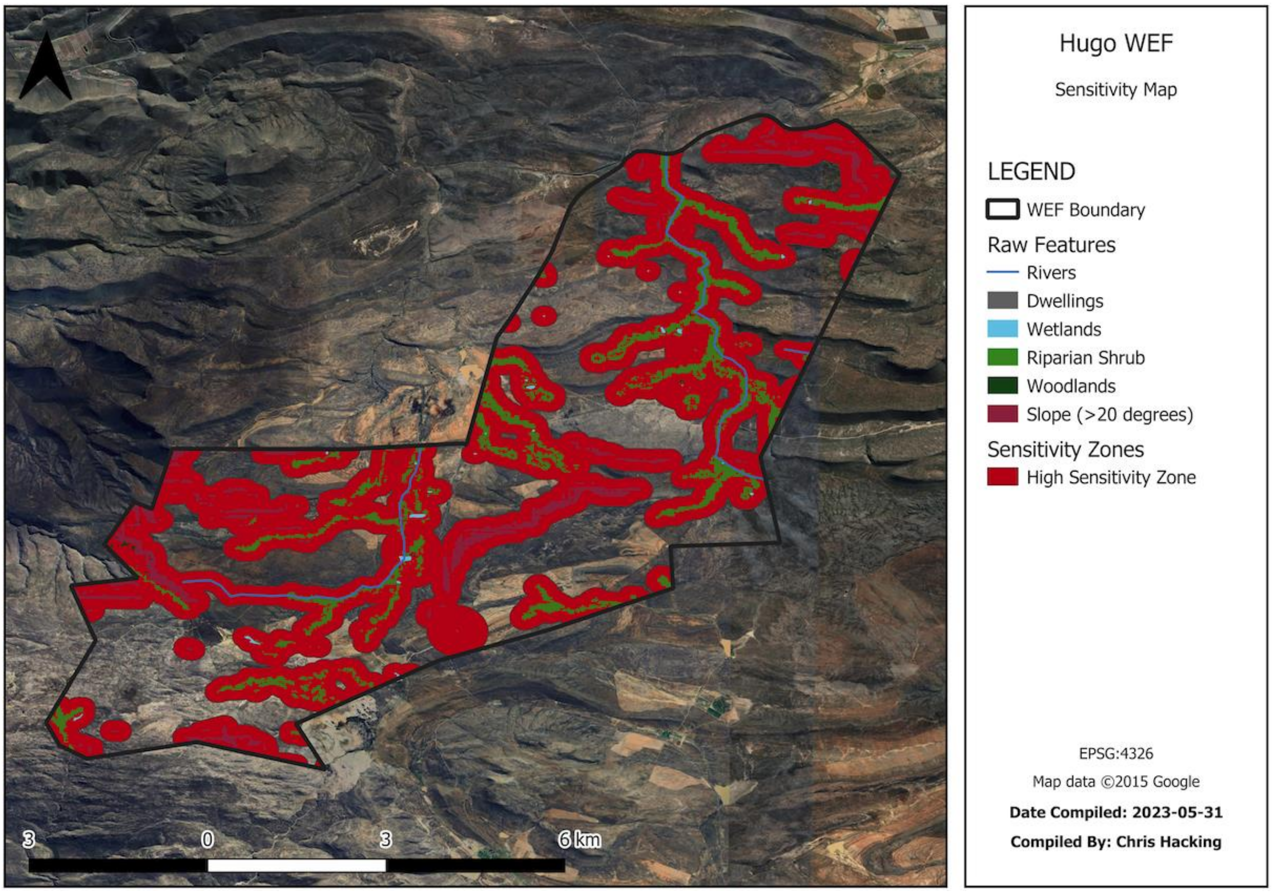

Figure 26: Preliminary bat sensitivity map of Hugo WEF.

7. CONCLUSION

Of the 12 species with distribution ranges that include the proposed development area, four have a conservation status of Near Threatened in South Africa and one Vulnerable, while three have a global conservation status of Near Threatened.

According to the likelihood of fatality risk, as indicated by the latest pre-construction bat guidelines six species, namely *Miniopterus natalensis* (Natal long-fingered bat), *Tadarica aegyptiaca* (Egyptian free-tailed), *Sauromys petrophilus* (Roberts's flat-headed bat), *Neoromicia capensis* (Cape Serotine bat), lately called *Laephotis capensis* (Cape roof bat) and the two Pteropodidae species (fruit bats) have a high risk of fatality, while *Myotis tricolor* (Temminck's myotis bat) has a medium-high risk and the endemic *E. hottentotus* has a medium risk of fatality.

Calls like five of the 12 species that have distribution ranges overlaying the proposed development site were recorded by the static recorders. 63% of the calls were from *Neoromicia capensis (Laephotis capensis)*, which is the dominant species on site. The second highest percentage of calls were from *Tadarida aegyptiaca* (28%), which is physiologically adapted to flying high and is thus at high risk of fatality, followed by the global as well as regional Near Threatened *Miniopterus natalensis* (7%), then *Sauromys petrophilus* (1%) and the endemic *Eptesicus hottentotus* (1%).

In total, nearly 100% of the bats recorded at the two high systems on the met mast (Systems A and B) belong to the two Molossidae species, *T. aegyptiaca* and *S. petrophilus*, while activity by *N. capensis (L. capensis)* is more active at the 10 m systems. When the present data is considered bat activity as well as species diversity are higher at lower altitudes at the proposed wind development.

Weekly temporal distribution of bat activity over the monitoring period generally indicates higher activity during autumn, from March to May 2023, with notably high activity by *N. capensis (L. capensis)* during these months. A sharp decline in activity was recorded towards the end of May, followed by low activity during the colder months, namely June to August.

When observing the species distribution at different monitoring systems, *N. capensis* portrays the highest recorded activity, with significantly more activity recorded at the 10 m masts and a near absence at higher altitudes. *T. aegyptiaca* portrayed the second highest activity and although this bat is widespread at the site, higher activity was recorded at 100 m (A) and 50 M (B) on the met mast. The highest activity of the Near Threatened *M. natalensis* was recorded at the 10 m mast L, situated near the centre of the site.

In general, there seems to be a decline in activity when observing the Hugo WEF bat data. If medians of the various systems are taken into consideration, the difference in bat activity at 100 m, 50 m and 10 m systems can be observed. There seems to be a decline in activity with increased altitude at the met mast, with System A, situated at 100 m, portraying lower activity when compared to System B, at 50 m, while System C, situated at 10 m portrays the highest activity on the met mast. The four 10 m systems (C, J, K and L) all recorded higher activity than the two systems at height (A and B).

Activity across all the systems increases at sunset, with a gradual incline in activity about an hour after sunset. Most systems recorded peak activity at approximately an hour after sunset (10 m Mast G) to approximately two hours after sunset (100 m A, 50 m B, 10 m C on the met mast, and 10 m Masts J, K, L). In general, a very peculiar pattern of high activity around sunset, with a gradual decline by the hour towards sunrise is seen. Bats at Hugo WEF seem to remain active up to the early morning hours when they return to their roosts before sunrise.

Extra care is taken with activity at Systems A and B, as these systems are situated within the sweep of the turbine blades with high activity from *T. aegyptiaca.* If present data of operational wind farms are considered, this species has the highest risk of fatality. The final report will provide a more complete picture of the whole monitoring period, indicating possible mitigation measures to curb predicted bat activity, if necessary.

A preliminary bat sensitivity map was compiled with the available data up to now. The bat sensitivity zones still need to be refined, incorporating data from the whole monitoring year; Therefore, there will be some changes in sensitivity zones.

In general, there are no red flags at this stage that suggest that the development could not progress to the next phase. However, this can only be confirmed when 12 months of bat monitoring has been considered. Correlations between bat data and weather conditions will be included in the final bat monitoring report.

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STEPHANIE DIPPENAAR: CV

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STEPHANIE CHRISTIA DIPPENAAR
Business owner: Stephanie Dippenaar Consulting trading as EkoVler

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EDUCATION

1986	BA University of Stellenbosch
1987	BA Hon (Geography) University of Stellenbosch
2000	MEM (Master in Environmental Management) University of the Free State

MEMBERSHIPS

- Steering committee of The South African Bat Assessment Association (SABAA)
- Active member of the National Bat Rescue Group (also known
- Member of the Southern African Institute of Ecologists and Environmental Scientists (SAIEES), since 2002.

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, contracted by Voice of America, involved in an Impact Assessment Study concerning shortwave towers on bird migration patterns.

- 1993 - 2004: University of Limpopo. Lecturer in the sub-discipline Geography, School of Agriculture and Environmental Sciences. Teaching post- and pre-graduate courses in environment related subjects in the Faculty of Mathematics and Natural Sciences, Faculty of Law, Faculty of Health and the Water and Sanitation Institute.
  - 2002-2004: Member of the Faculty Board of the Faculty of Natural Sciences and Mathematics.
  - 2002: Principal investigator of the Blue Swallow project, Northern Province, Birdlife SA.
  - 2002: Evaluating committee for the EMEM awards (award system for environmental practice at mines in South Africa)
  - 2001-2004: Private consultancy work, focussing on environmental management plans for game reserves.
- 2004-2011: CSIR, South Africa, doing environmental strategy and management plans and environmental impact assessments, mainly on renewable energy projects.
- 2011 onwards: Sole proprietor private consultancy.
- From 2015 to 2017: Teaching a part-time course in Environmental Management to Post-graduate students at the Department of Geography and Environmental Studies, University of Stellenbosch.

PROJECT EXPERIENCE RECORD

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

Completion	Project description	Role
In progress	Preconstruction Bat monitoring at Khoe Wind Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Hugo Wind Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Kraaltjies Wind Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Heuweltjies Wind Energy Facility	Bat specialist
2023	Preconstruction Bat monitoring at Ezelsjacht Wind Energy Facility	Bat specialist
2023	Operational bat monitoring at Roggeveld Wind Farm	Bat specialist
In progress	Operational bat monitoring at Kangnas Wind Farm	Bat specialist
In progress	Operational bat monitoring at Perdekraal East Wind Farm	Bat specialist
2022	Preconstruction Bat monitoring at Juno 2 Wind Energy Facility	Bat specialist
2022	Preconstruction Bat monitoring at Juno 3 Wind Energy Facility	Bat specialist
2022	Background study for the impact on bats by Small Scale Wind Turbines in Cape Town Municipality	Bat specialist
2022	Preconstruction Bat monitoring at Patatskloof Wind Energy Facility	Bat specialist
2022	Preconstruction Bat monitoring at Karee Wind Energy Facility	Bat specialist
In progress	Operational bat monitoring at Excelsior Wind Farm	Bat specialist

Completion	Project description	Role
2021	Preconstruction Bat monitoring at Koup 1 Wind Energy Facility	Bat specialist
2021	Preconstruction Bat monitoring at Koup 2 Wind Energy Facility	Bat specialist
In progress	Preconstruction bat monitoring for two wind energy facilities at Kleinzee	Bat specialist
2021	Preconstruction bat monitoring at Gromis Wind Energy Facility	Bat specialist
2021	Preconstruction bat monitoring at Komas Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Kappa 1 Wind Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Kappa 2 Wind Energy Facility	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 for Mainstream	Bat specialist
2019	Preconstruction bat impact assessment for the Bosjesmansberg Wind Farm	Bat specialist
2018	Preconstruction Bat Monitoring at the Tooverberg Wind Energy Facility	Bat specialist
2016	Bat "walk through" for the Hopefield Powerline associated with the Hopefield Community WEF	Bat specialist
2016	Environmental Management Plan for Elephants in Captivity at the Elephant Section, Camp Jabulani, Kapama Private Game Reserve.	Project Manager
2016	Environmental Management Plan for Hoedspruit Endangered Species Centre, Kapama Game Reserve.	Project Manager
2012-2013	Bat impact assessment for the Karookop Wind Energy Project EIA.	Bat specialist
2012	Bat specialist study for Vredendal Wind Farm EIA.	Bat specialist
2011-2012	Bat monitoring and bat impact assessment for the Ubuntu Wind Project EIA, Jeffreys Bay.	Bat specialist
2011	Bat specialist study for the Banna Ba Pifhu Wind Energy Development, Jeffrey's Bay.	Bat specialist
2011(project cancelled)	Basic Assessment for the development of an air strip outside Betty's Bay.	Project Manager
2011	Bat specialist study for the wind energy facility EIA at zone 12, Coega IDZ, Port Elizabeth.	Bat specialist
2010-2011	Bat specialist study for the Wind Energy Facility EIA at Langefontein, Darling.	Bat specialist
2010-2011	Bat specialist study for the EIA concerning four wind energy development sites in the Western Cape.	Bat specialist
2010	Bat specialist study for Electrawinds Wind Project EIA, Port Elizabeth.	Bat specialist

Completion	Project description	Role
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 (Letf CSIR before completion of project, Authorisation rejected).	Project Manager
2007-2008	Environmental Impact Assessment for the Kouga Wind Farm, Jeffrey's Bay, Eastern Cape (Authorisation received).	Project Manager
2006-2008	Site Selection Criteria for Nuclear Power Stations in South Africa.	Co-author
2005	Auditing the Environmental Impact Assessment process for the Department of Environment and Agriculture, Kwazulu Natal, South Africa	Project Manager
2005	Background paper on Water Issues for discussions between OECD countries and Developing Countries.	Author
2005	Integrated Environmental Education Strategy for the City of Tshwane.	Co- author
2005	Developing a ranking system prioritizing derelict mines in South Africa, steering the biodiversity section.	Contributor
2005	Policy and Legislative Section for a Strategy to improve the contribution of Granite Mining to Sustainable Development in the Brits-Rustenburg Region, Northwest 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

- Presentation, representing SABAA, at the Windaba Conference 2023.
- Member of the Steering Committee of the South Africa Bat Assessment Association.
- Active member of the National Bat Rescue Group.
- Attend binary Bats and Wind Energy workshops hosted by SABAA.
- Updated basic fall arrest certification and occupational health certificate.
- 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 Elaenor Richardson, Kirstenbosch, 27 August 2014
- Mist netting and bat handling course by Dr. Sandie Sowler, Swellendam, 5 November 2013.

- Attendance and fieldwork to identify bat species and look at new Analook software with Chris Corben, the producer of the Analook bat identification software package and the Anabat Detector, during 10 and 11 October 2013.
- 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.

PUBLICATIONS

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

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

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

REFERENCES

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