Mobile: Sam - 072 437 1742
Mobile: Luke - 083 784 1997
Email: info@enviro-insight.co.za
Website: www.enviro-insight.co.za

Appendix E (3):

Bat Preconstruction Monitoring Assessment

Scoping Report: Pre-construction Bat Monitoring Assessment for the Proposed Botterblom Wind Energy Facility located north of Loeriesfontein in the Northern Cape Province.

MAY 2021

Prepared For

FE Botterblom (Pty) Ltd

Prepared by

Enviro-Insight CC

Low de Vries (*Pr. Sci. Nat.*)

Luke Verburgt (*Pr. Sci. Nat.*)

Alex Rebelo *(Cand. Sci. Nat.*)

Sam Laurence (*Pr. Sci. Nat.*)

info@enviro-insight.co.za

AUTHOR CONTRIBUTIONS

Author	Qualification	SACNASP	Role in project
Low de Vries	PhD Zoology	*Pr. Sci. Nat. - 124178*	Field work, report writing, reviewing
Alex Rebelo	MSc Herpetology	*Cand. Sci. Nat.* - 124303	Field work, data analyses
Luke Verburgt	MSc Zoology	*Pr. Sci. Nat.400506/11*	Project management, senior reviewer
Sam Laurence	MSc Zoology	*Pr. Sci. Nat.*- 400450/13	Field work

EXPERTISE OF BAT SPECIALISTS

Low de Vries is a registered bat assessment specialist with SABAA and has consulted for numerous field projects, which included bird surveys and the removal of dangerous snakes in Mozambique, as well as several biodiversity surveys in South Africa. He obtained a PhD in Zoology while investigating the general ecology of aardwolves with special focus on home range, diet and prey abundance. After his PhD he spent 14 months on Marion Island assisting with field work on elephant seals, fur seals and killer whales. During his subsequent (and current) postdoctoral position at the University of Pretoria he spent three years conducting research on the ecology of bats and has obtained extensive knowledge on bat behaviour and experience in bat handling.

Disclaimer by specialists

We,

Dr. Low de Vries	Sam Laurence	Luke Verburgt	Alex Rebelo
Pr. Sci. Nat.	*Pr. Sci. Nat.*	*Pr. Sci. Nat.*	*Cand. Sci. Nat.*

declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

Checklist according to SABAA guidelines (MacEwan *et al*. 2020)

Scoping-specific Guideline requirement	**Section in report**	**Completed**
Literature review: collation and review of existing literature	3.1 Literature review	Yes
Identify habitats which may be used by bats	3. Results	Yes
Desktop search for any designated Protected Areas within 100 km of the site	3.1 Literature review	Yes
Indicate the entire area of interest supplied by the developer/ client.	1.2 Project location and area of influence	Yes
A walkover survey for small sites/drive-through survey for large sites	2.2 Field Surveys	Yes
Preconstruction Guideline requirement		
Determine the assemblage of potentially occurring and detected bats and present their fatality risk	3.2 Acoustic Monitoring	Yes
Determine presence of rare bats and Species of Conservation Concern (SCC)	3.2 Acoustic Monitoring	Yes
Locate bat roosting habitat in the study region	3.3 Roosting sites	Yes
Compare differences in the assemblage and activity of bats between ground level and rotor sweep height	3.2.1.3 Passes at	Yes - Seasonally
Compare differences in the assemblage and activity of bats between monitoring localities and between different habitat types	3.2 Acoustic Monitoring	Yes - Seasonally
Determine seasonal variation in the assemblage and activity of bats	3.2.1.2 Passes by	Yes - Seasonally
Identify any incidence of bat migration	3.2.1.2 Passes by	No
Determine variation in the assemblage and activity of bats between sunset and sunrise	3.2.1.2 Passes by	Yes
Determine how wind speed and other meteorological conditions correlate with bat activity	3.2.1.4 Environmental Variables on bat activity	No –Environmental variables not provided
Determine the relative importance/sensitivity of different parts of the site	3.5 Bat sensitive features	Yes - Seasonally
Determine the relative importance/sensitivity of the site	3.5 Bat sensitive features	Yes - Seasonally
Identify potential site-specific impacts of the proposed WEF on bats.	3.5 Bat sensitive features	Yes - Seasonally
Describe effective site- and habitat/turbine-specific bat mitigation measures	4. Possible Impacts	Yes
Monitoring duration in relation to the size of the WEF (MW) and its position relative to REDZ.	2.1Regulatory requirements	Yes
The area of influence (AOI)/ study area and turbine layout if provided by the developer	4. Possible Impacts	Yes
Consider the potential impacts of ancillary developments	4. Possible Impacts	Yes
Roost surveys of potential and known roosts in Summer and Winter	3.3 Roosting sites	Yes - Seasonally
Identify medium to large roosts or caves within 20 km of study area	3.3 Roosting sites	Yes
Manual transect or point acoustic surveys for 8 nights even spread across all seasons	3.2.2 Active Monitoring	Yes - Seasonally
Static surveys with fixed acoustic song meters as per the site size and WEF design	3.2 Acoustic Monitoring	Yes - Seasonally

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Acoustic monitoring: Recording and analyses of echolocation calls to determine bat species composition and abundance.

Bat call: An echolocation call emitted by a bat used to detect its surroundings and navigate through the habitat it inhabits.

Bat detector: Electronic device for the recording of bat echolocation calls.

Bat roost: A structure, natural or manmade, were bats roost during the day. This includes caves, tress, rocky outcrops, buildings and culverts.

Blade tip sweep height: Height between ground level and the lowest point of the rotor sweep zone.

Buffer zone: A zone established around areas that are identified as sensitive for bats and includes flyways, foraging areas and bat roosts.

Cumulative Impact: Impacts created due to past, present and future activities and impacts associated with these activities.

Echolocation: Navigation through the use of ultrasound.

Environmental Impact Assessment (EIA): The process of identifying environmental impacts due to activities and assessing and reporting these impacts.

EMPr: Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Endemic: A species that is restricted to a particular area.

IUCN: International Union for Conservation of Nature.

Preconstruction phase: The period prior to the construction of a wind energy facility.

Pulse: A single emission of a sound by a bat.

Red data species: Species included in the endangered, vulnerable or rare categories as defined by the IUCN.

Renewable Energy Development Zones (REDZ): Areas were wind and solar photovoltaic power development can occur in concentrated zones.

Rotor blades: The air foil of a wind turbine that catches the wind and rotates.

Rotor swept area: The area through which rotor blades rotate.

SABAA: South African Bat Assessment Association.

SACNASP: South African Council for Natural Scientific Professions.

Scoping Report: A report contemplated in regulation 21 of the NEMA amended EIA regulations R326 dated 7 April 2017.

Turbine: A device that harnesses wind energy and turns it into kinetic energy used for the generation of electricity.

WEF: Wind Energy Facility.

1 INTRODUCTION

1.1 PROJECT DETAILS AND BACKGROUND

Enviro-Insight CC was commissioned by FE Botterblom (Pty) Ltd to conduct a pre-construction bat survey for a proposed wind energy facility (WEF) and associated infrastructure which will be known as Botterblom WEF. Up to 54 wind turbines will be constructed, each being at a 5.2 MW capacity with a hub situated between 120-160 m above ground level and a blade length of 70 m [blade tip sweep height: 50-90 m above ground level]. A substation and workshop/office with access control will be constructed on site, including access roads measuring up to 6 m in width linking turbines with other infrastructure. A 132 kV transmission power line measuring less than 5 km in length will be used to connect the WEF to the Helios Transmission Substation. This survey serves as a pre-construction assessment of the bat activity and bat species present in the Area of Influence (AOI) of the proposed WEF.

1.2 PROJECT LOCATION AND AREA OF INFLUENCE

The proposed Botterblom WEF (WEF boundary in Figure 1-1) is located 53 km north of Loeriesfontein on the remaining extent of Farm Sous 226 in the Hantam Local Municipality in the greater Namakwa District Municipality of the Northern Cape province, South Africa, and covers an area of 5 796 ha. This site has historically been used for sheep grazing and is virtually undisturbed by human presence. A regional road and railway run through the AOI (AOI = WEF boundary). The Khobab and Loeriesfontein 2 WEF (Animalia, 2011) has been constructed to the north and north-east of the area proposed for the current WEF, and as such, existing infrastructure is present on and in the vicinity of the current AOI, including an existing sub-station in the eastern section of the AOI.

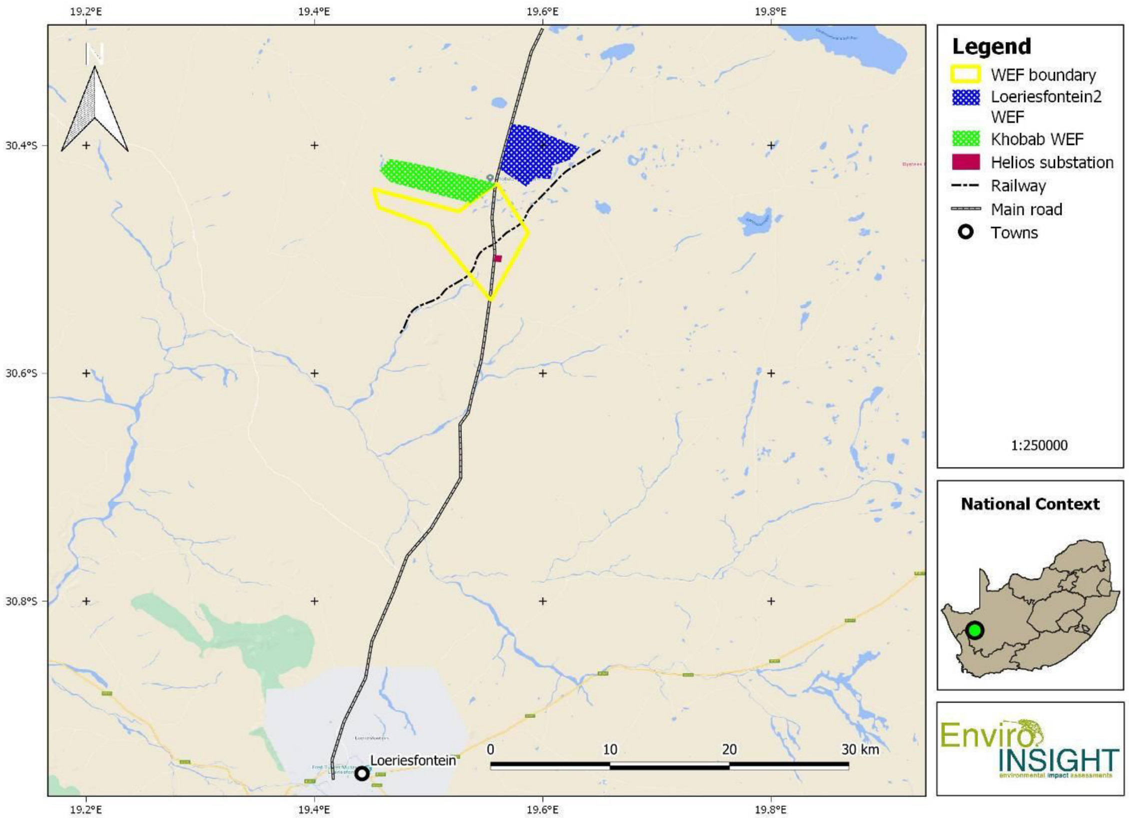

Figure 1-1: Locality of the project area of influence for the proposed development.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The project area is located in the Nama Karoo Biome and is characterized by Bushmanland Basin shrubland (SANBI, 2018; Figure 1-2). Based on the ecoregions delineated by Dinerstein *et al*. (2017), the entire project area is located in the Gariep Karoo ecoregion (Figure 1-3), analogous to the Nama Karoo Shrublands ecoregion discussed in MacEwan *et al.* (2020). Despite the more recent and updated nature of the ecoregions delineation provided by Dinerstein *et al.* (2017), the SABPG (MacEwan *et al*., 2020) preferentially use the ecoregions delineation of Olson *et al.* (2001), which indicates that a small portion in the southern part of the project area falls within the Succulent Karoo ecoregion (Figure 1-4). Given that there is no obvious difference in the recently delineated regional vegetation map (SANBI, 2018; Figure 1-2) and that our observations in the field also failed to detect any obvious vegetation differences in this southern portion, we preferentially apply the more recent and updated ecoregion delineation from Dinerstein *et al.* (2017) for this project area and therefore asses bat fatality risk for the whole project area according to the Nama Karoo ecoregion thresholds defined in Table 5 of the SABPG (MacEwan *et al*., 2020).

The area is characterised by small dry river courses and drainage lines, with no permanent water and only seasonal (ephemeral) pans are present. The topography is relatively flat, with no steep rises. Average maximum temperature for the warmest month of the year (January) is *ca.* 30 °C and minimum for the same period 17 °C. Average maximum and minimum temperature during the coldest months is 15 °C and 2 °C respectively (Animalia, 2011). The project area is located in a winter rainfall region with the wettest month being June and receives an average of 14.1 mm of rain per year (Animalia, 2011).

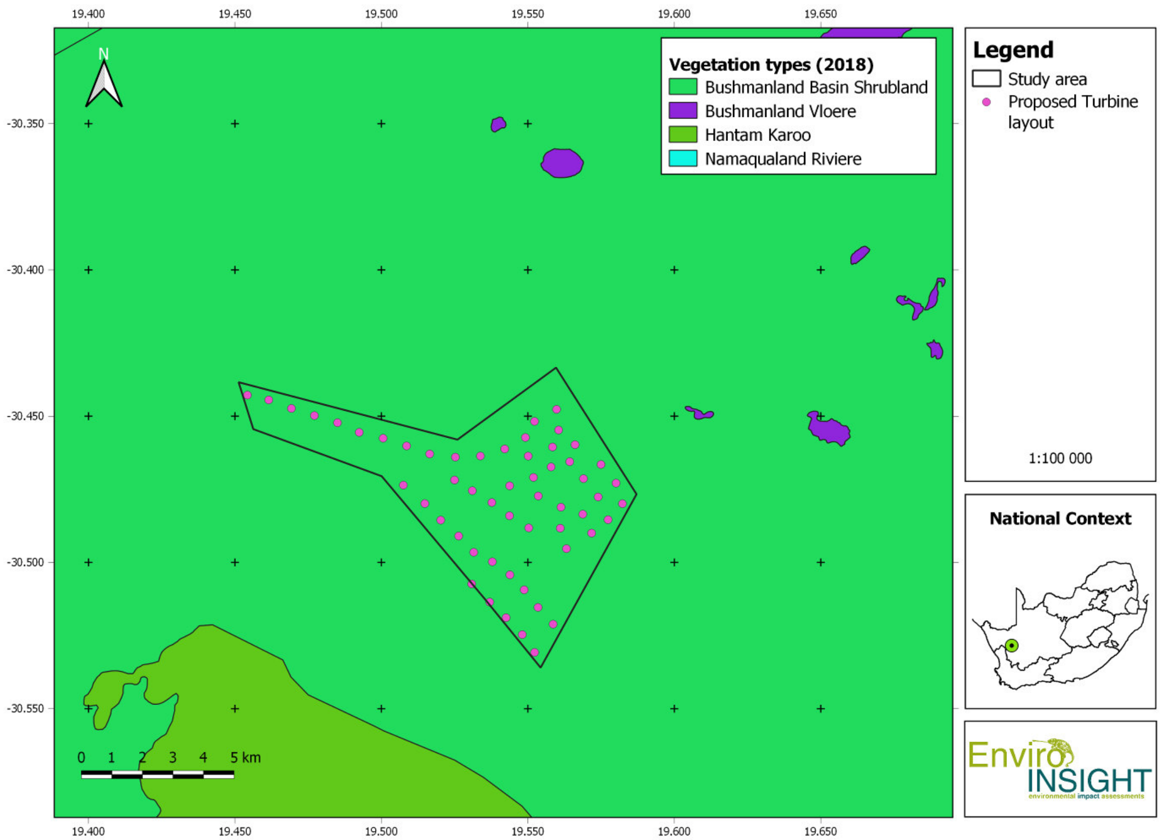

Figure 1-2: Vegetation types around the area of the proposed Botterblom Wind Energy Facility.

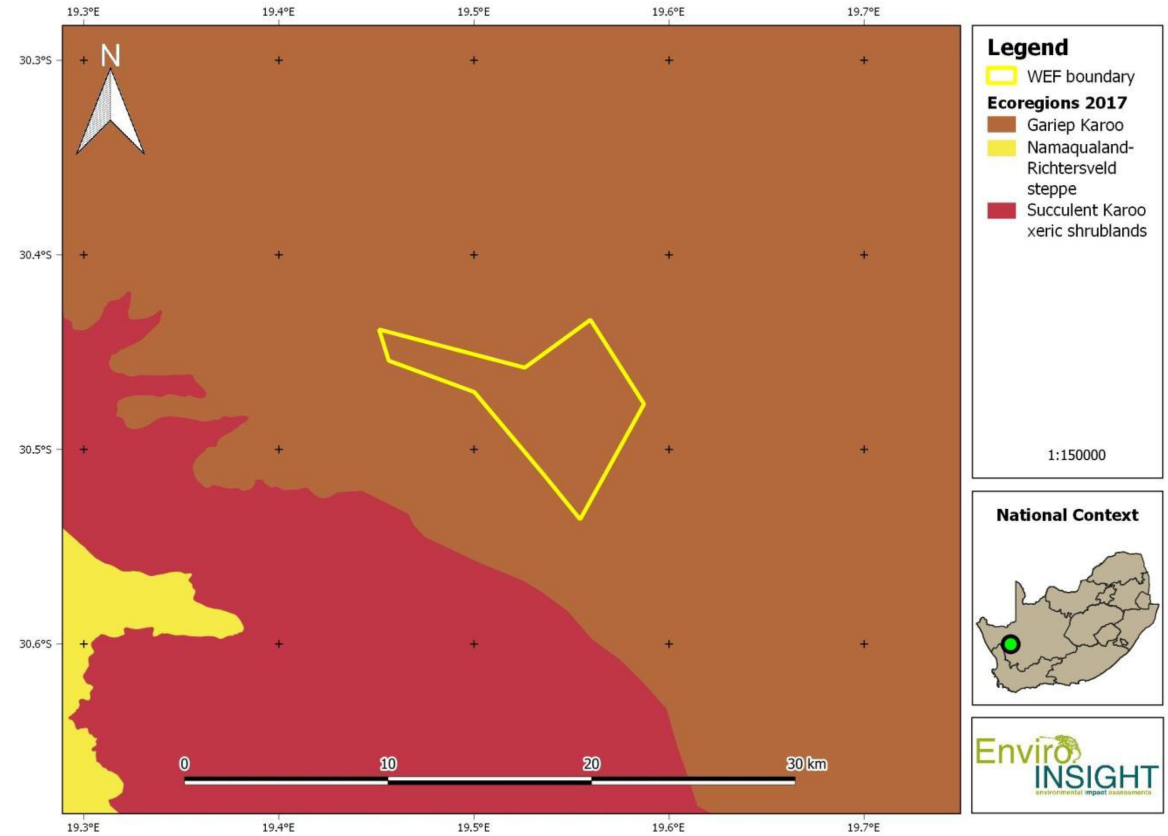

Figure 1-3: Ecoregions (Dinerstein et al. 2017) around the area of the proposed Botterblom Wind Energy Facility.

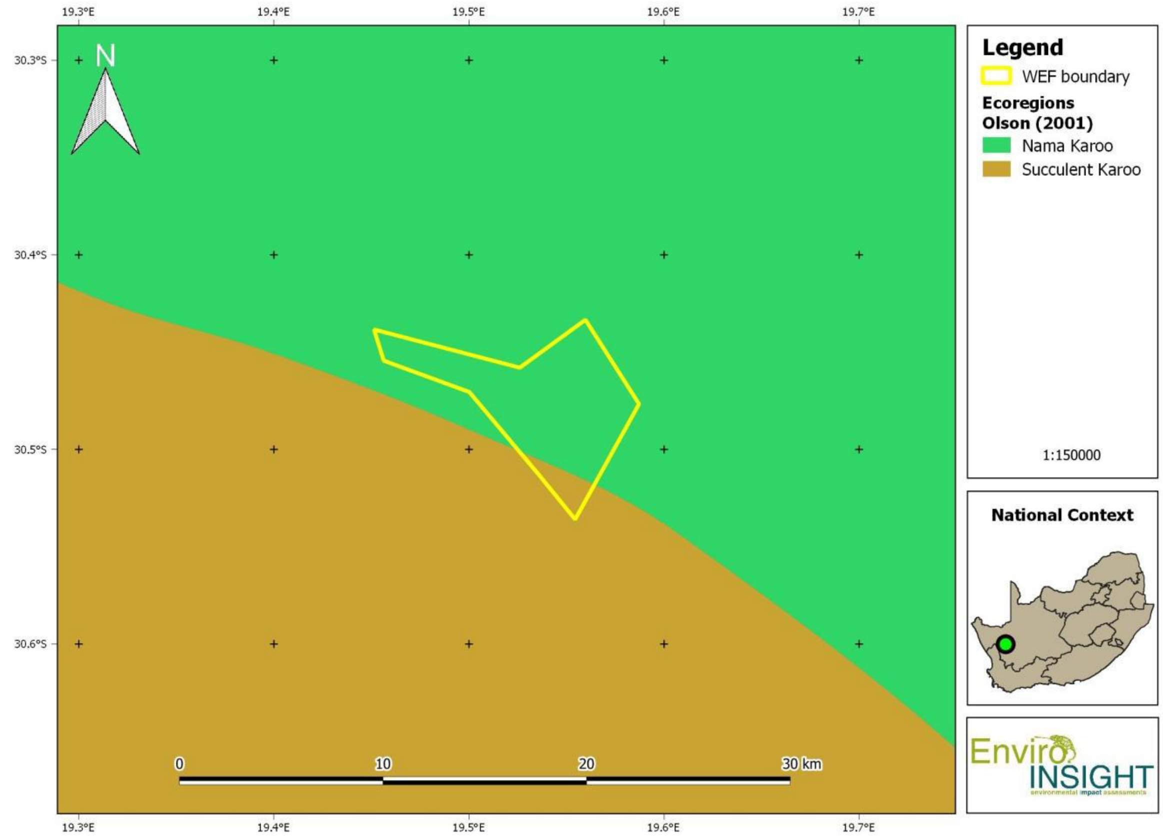

Figure 1-4: Ecoregions (Olson et al. 2001) around the area of the proposed Botterblom Wind Energy Facility.

1.4 BAT STUDY VALIDITY PERIOD

The current survey is only representative for the spring and summer months (September 2020 to January 2021), and no inferences should be drawn from these data for a longer period. Bats are known to migrate before winter periods or annually to maternity roosts (Jacobsen and du Plessis, 1976), and as such the species assemblages for the area could potentially be vastly different during other periods of the year. The current survey will be conducted over a period of 12 months, and after completion will be valid for a five-year period.

1.5 ASSUMPTIONS AND LIMITATIONS

Distribution records of bats in southern African are still poorly reported and limited for many species. In addition, migratory patterns of bats are largely unknown in South Africa. Studies have reported that bats do migrate, but the exact routes followed are not known (Pretorius *et al*., 2020). The same is true for breeding behaviour and the formation of maternity colonies for many species.

WEF pre-construction monitoring reports on bats are reliant on reporting echolocation calls (if no bat mortality data from adjacent facilities are available), but without echolocation call libraries accurate identification of calls is not always possible.

Published libraries created from release and handheld calls from captured bats are available for southern Africa but are geographically limited. The echolocation calls of a particular species from different regions in South Africa are known to vary to some degree (Monadjem *et al*., 2020), and as such call libraries created in different regions are not always comparable. SABAA was contacted for assistance on how to obtain bat mortality data from post-construction monitoring of the existing Khobab WEF to the north. Such mortality data are considered essential for the interpretation of risk and evaluation of the potential mortality that can be expected from the Botterblom proposed WEF, given its immediately adjacent spatial location and similar land use. The original request for assistance in this regard from SABAA was sent on 9 February 2021, followed by a series of follow-up queries from 9 April 2021. Unfortunately, no data or reporting had yet been received from SABAA at the time of submission of this report (1 June 2021). SABAA did however indicate that they would attempt to acquire this data and share it with Enviro-Insight. It is anticipated that such data will be provided by SABAA (or alternatively obtained from DFFE) following the submission of this scoping report, where after it will be incorporated into the impact analysis of the final report.

The height of the turbines, diameter of the rotor blades and height of the meteorological mast were not readily available from the developer until the monitoring had already commenced. As such, a bat detector was initially placed only at 50 m as required for met masts of 80 m by the SABAA South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5es (SABPG, MacEwan *et al*., 2020), and an additional bat detector was not deployed above 80 m. This means that bats flying at a height of above 80 m were initially not recorded, and some bats foraging at height were not detected. At the beginning of December 2020, this was brought to the developers' attention, but an additional bat detector was only erected in March 2021 at 100 m. The additional bat detector will give a better representation of bats that fly in the rotor sweep zone which could place them at risk of collision or barotrauma. As a suggestion, all recorders should continue to collect data until the final EIR is submitted to the competent authority (currently scheduled for submission in November 2021), and if considered necessary up until the outcome of the competent authorities' decision (which should be around the end of March 2022).

Bat detectors are not always effective in recording echolocation calls for all bat species, and some species may be missed e.g., fruit bat species that do not echolocate. Additionally, species such as *Nycteris thebaica* emit low intensity calls that may not be recorded. Bat detectors are also limited in the range over which a call can be recorded, and this can be further influenced by environmental conditions such as humidity. In addition, the microphones that are coupled to the detectors are not omnidirectional and recording quality and number of recordings is influenced by the orientation of the call relative to the microphone.

Technical difficulties are inevitable when dealing with large quantities of data. Recording time was compromised by batteries going flat before being replaced, SD card corruption, recorder device failure and user error when replacing batteries and card (accidentally disabling device).

2 METHODOLOGY

2.1 REGULATORY REQUIREMENTS

Amendments were made to the NEMA: EIA Regulations of 2014: GNR 326 EIA Regulations; GNR 327 Listing Notice 1; GNR 325 Listing Notice 2; GNR 324 Listing Notice 3 which pertains to WEF and the activities surrounding their construction. Under Listing Notice 2 it is stated that a Scoping and Environmental Impact Assessment (S&EIA) is required for WEF with an electricity output 20 MW or more and which is not located in an urban area or on existing infrastructure. Only a Basic Assessment (BA) is, however, required in cases where the entire boundary of the proposed WEF is located in a Renewable Energy Development Zone (REDZ). The Botterblom WEF is not located in a REDZ, and accordingly a S&EIA process will be followed. The SABPG for WEF (MacEwan *et al*., 2020) does, however, not differentiate between areas located within or outside of a REDZ, and as such the same measures outlined in these guidelines must be followed and applied. Monitoring of bats must be conducted before the final BA or EIA is submitted.

2.2 DESKTOP SURVEY

A thorough desktop study was undertaken to estimate the likelihood of specific species of bats being present at the proposed WEF project area. This included a detailed study of available literature, which included the pre-construction reports for the adjacent Khobab WEF (Animalia, 2011) and the Kokerboom 1 WEF (Animalia, 2017), available distribution maps of bat species and records from the African Chiropteran Report (ACR, 2020) which includes museum records. In addition, a search was performed to identify all protected areas within 100 km of the AOI using Protected Planet (https://www.protectedplanet.net/). Although requested, no bat mortality data could be obtained from the Khobab WEF to incorporate into the current report.

Table 2-1: Reports for Wind Energy Facilities in the areas around the current project area.

Project	Bat Assessment	Author and Company
SiVEST. 2012. Proposed Construction of Wind Farms near Loeriesfontein, Northern Cape Province, South Africa.	Environmental Constraints Analysis with regards to bat (Chiroptera) sensitivity - For the proposed Loeriesfontein Wind Energy Facility near Loeriesfontein, Northern Cape (2011).	Werner Marais – Animalia
SiVEST. 2015. Proposed Development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province, South Africa. Final Environmental Impact Report. DEA Ref No: 14/12/16/3/3/2/690		Werner Marais – Animalia
AURECON. 2017. Proposed Kokerboom 1 Wind energy Facility and associated infrastructure on Farms RE/227 and 1163, near Loeriesfontein in the Northern Cape: Final Environmental Impact Report. DEA REF. NO.: 14/12/16/3/3/2/985.	Findings of a 12-month Long-Term Pre-Construction Bat Monitoring Study and Impact Assessment For the proposed Kokerboom 1 Wind Farm, Northern Cape (2017)	Daleen Burger – Animalia

AURECON. 2017. Proposed Kokerboom 2 Wind energy Facility and associated infrastructure on Farms 1164 and RE/215, near Loeriesfontein in the Northern Cape: Final Environmental Impact Report. DEA REF. NO.: 14/12/16/3/3/2/986.	Findings of a 12-month Long-Term Pre-Construction Bat Monitoring Study and Impact Assessment For the proposed Kokerboom 2 Wind Farm, Northern Cape (2017)	Daleen Burger – Animalia
AURECON. 2017. Proposed Kokerboom 3 Wind energy Facility and associated infrastructure on Farms RE/213, 1/214 and 2/214, near Loeriesfontein in the Northern Cape: Final Environmental Impact Report DEA REF. NO.: 14/12/16/3/3/2/1009.	Findings of a 12-month Long-Term Pre-Construction Bat Monitoring Study and Impact Assessment For the proposed Kokerboom 3 Wind Farm, Northern Cape (2017)	Werner Marais – Animalia
	Fifth and Final Progress Report of a 12-month Long-Term Bat Monitoring Study - For the proposed !Xha Boom Wind Energy Facility, Northern Cape (2017)	Daleen Burger – Animalia
	Fifth and Final Progress Report of a 12-month Long-Term Bat Monitoring Study - For the proposed Graskoppies Wind Energy Facility, Northern Cape (2017)	Daleen Burger & Werner Marais – Animalia

2.3 FIELD SURVEYS

All methods used for field surveys were done according to the South African Bat Assessment Association's (SABAA) document on best practice guidelines for pre-construction monitoring of bats at wind energy facilities in South Africa (MacEwan *et al*., 2020).

2.3.1 Site visits

Several site visits have been completed to date (Table 2-2) spanning spring to late summer. A selection of representative photographs of the different bat detectors and the different habitats in the AOI is shown in Figure 2-2.

Table 2-2: Summary of site visits and work conducted.

Season and Dates	Methods	Weather conditions	Comments
Spring: 1-5 September 2020	Scoping Phase	End of winter rain – vegetation sparse and plants starting to wilt.	The static bat detectors were deployed.
Early summer: 10-14 November 2020	Walk, Drive	Dry and hot conditions. Vegetation minimal, bare landscape.	Transect were walked and driven and data retrieved from bat detectors
Summer: 9-11 December 2020	Bat roosts	Dry and hot conditions. Vegetation minimal, bare landscape.	Roost inspection was done and data retrieved from bat detectors
Late summer: 15-17 March 2021	Bat roosts	After good rains. Green vegetation with grass cover. Wetland pans filled with water.	Roost inspection was done and data retrieved from bat detectors

2.3.2 Walkover survey

A survey was performed by walking and driving across the project area as a ground truthing exercise to identify suitable areas for placement of bat detectors, identify potential roosting sites and sensitive areas and evaluate the level of monitoring that is required. This was performed prior to the deployment of the bat detectors.

2.3.3 Passive song meters

Nightly recordings of bats from dusk to dawn were captured using the Wildlife Acoustics Song Meter SM4BAT FS Ultrasonic Recorders (hereafter referred to as "bat detectors"). A total of five bat detectors were deployed throughout the project area, spatially arranged to cover all major habitat types and/or important bat habitat features (Table 2-1; Figure 2-1). As per the SABPG (MacEwan *et al*., 2020), one bat detector must be deployed at a height of 7 - 10 m per 5 000 ha or for every significant biotope on the project AOI and one detector must be deployed at a height of 50 – 80 m per 10 000 ha for mast that are 80 m tall. If a mast is taller than 80 an additional bat detector must be deployed as close to the top of the mast as possible. This considered, four bat detectors were deployed at 7 m above ground level, whereas one was deployed at 50 m (Figure 2-2). An additional recorder was placed at 100 m, but only started recording in March 2021 (the data for this is not presented in this report – refer to the limitations section above). All devices were scheduled to record from 30 min before sunset to 30 min after sunrise at the location of the bat detector. During this time, the device is 'armed' and will begin a recording if a 'trigger' is detected. A trigger is defined as a sound within the set frequency range (Default: >16 kHz) amplitude (Default: 12 dB) for a minimum duration (Default: 1.5 ms). The recording then continues for the duration of the Trigger Window (Default: 3 second) after the last Trigger, and then saves the recorded data. If there are constant Triggers, the recording will save and close after the maximum length of a recording file (Default: 00m:15s). The batteries for the bat detectors were exchanged approximately every month and at this time all data were copied from the SD card and backed up.

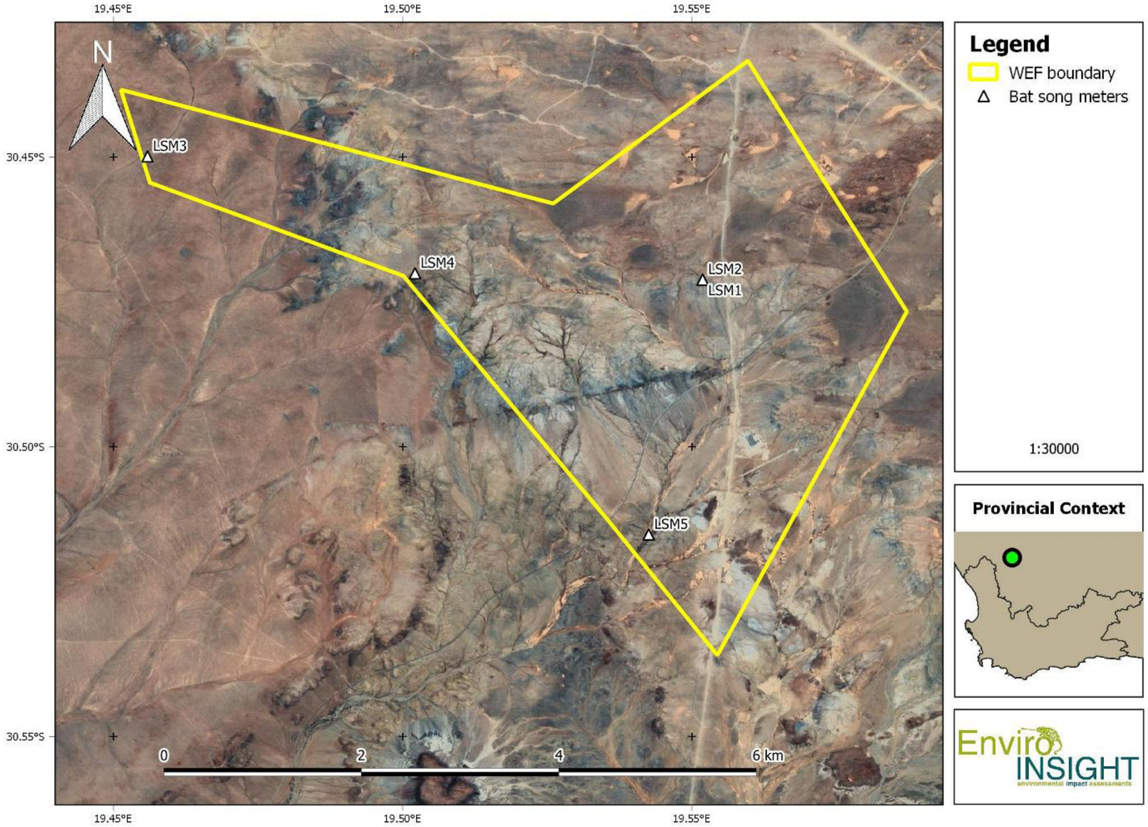

Figure 2-1: Passive bat song meter locations showing the setup and immediate surrounding habitat.

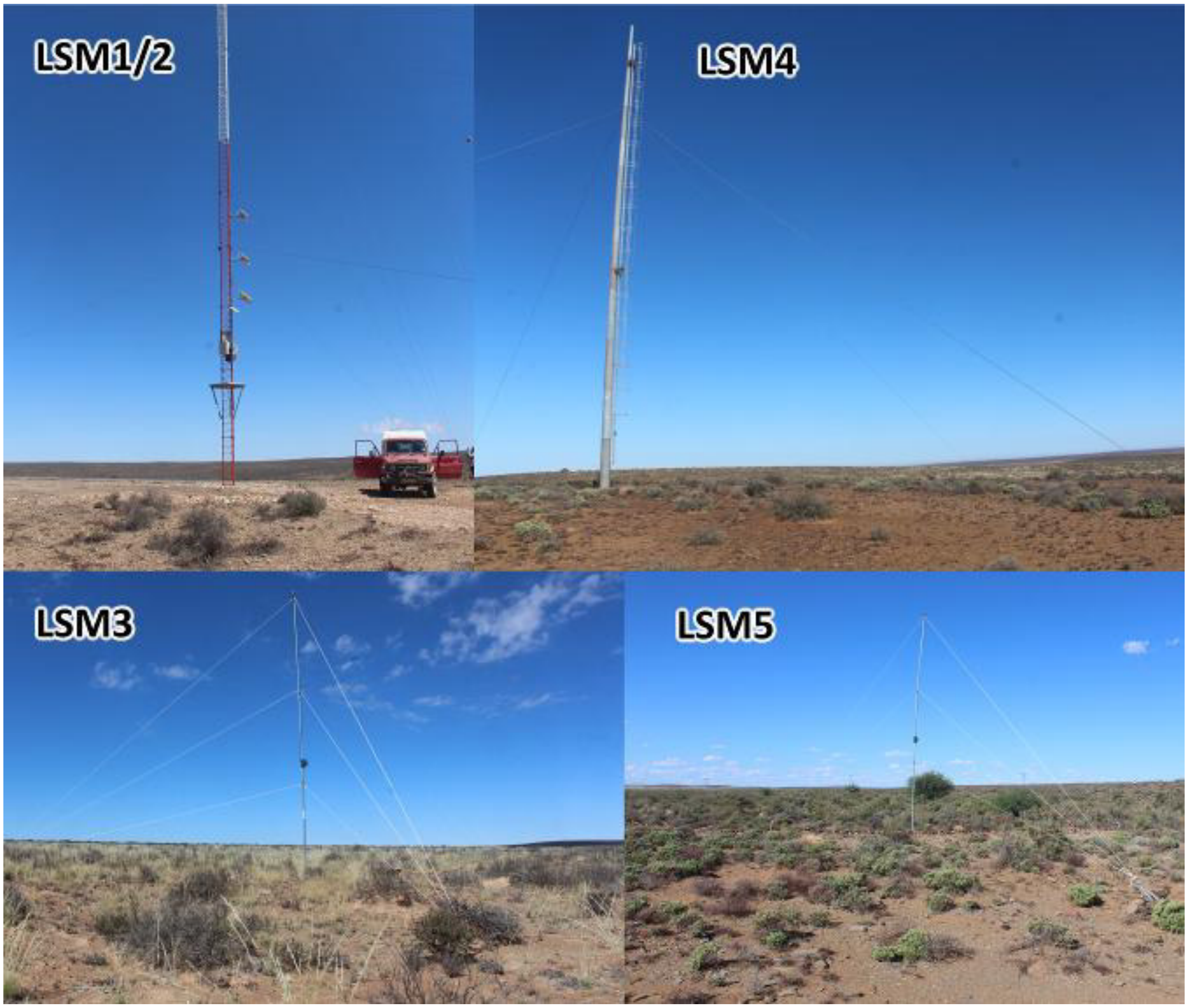

Figure 2-2: Passive bat song meter locations showing the setup and immediate surrounding habitat.

Table 2-3: The details of the deployed bat detectors.

Bat Detector ID	Microphone Height above ground	Latitude (°)	Longitude (°)	Date deployed
LSM1	50 m	-30.471144	19.551831	04/09/2020
LSM2	7 m	-30.471144	19.551831	04/09/2020
LSM3	7 m	-30.449887	19.45587	04/09/2020
LSM4	7 m	-30.47005	19.502112	05/09/2020
LSM5	7 m	-30.515138	19.542507	04/09/2020
LSM6	100 m	-30.471144	19.551831	20/03/2021

2.3.4 Active transects

At the time of this report compilation, only summer transects had been performed, covering 4 consecutive nights (Table 2-4). By the end of the 12-month period, a minimum of 8 nights of active sampling will be completed across all four seasons (2 nights per season). Initially, not all transects were driven for the 2.5 hours per night between dusk and 4 hours after dusk as per the SABPG (MacEwan *et al*., 2020), but rather divided into smaller sections in order to cover more ground throughout the night. As such, more transects were driven and walked, and the total transect duration exceeded the minimum requirement of 5 h total survey duration over 2 nights as stipulated in MacEwan *et al*. (2020). Transects were only conducted under fair weather conditions (nights with rain or strong winds were avoided). Bats were recorded using a Song Meter SM4BAT FS Ultrasonic Recorder with the microphone held outside the vehicle while driving at a maximum of 35 km/h along the same transect routes between survey periods. All transects were tracked using a handheld GPS.

Table 2-4: The details of active transects completed.

Season	Type	Date	Time start	Time end	Duration (HH:MM)	Nightly Duration Total
Summer	drive	10/11/2020	18:00	19:02	01:02	02:03
Summer	drive	10/11/2020	19:10	19:53	00:43	
Summer	drive	10/11/2020	19:53	20:11	00:18	
Summer	drive	11/11/2020	18:57	19:23	00:26	01:39
Summer	walk	11/11/2020	19:38	19:56	00:18	
Summer	drive	11/11/2020	19:44	20:14	00:30	
Summer	drive	11/11/2020	20:17	20:42	00:25	
Summer	walk	12/11/2020	18:55	20:21	01:26	01:41
Summer	drive	12/11/2020	20:22	20:37	00:15	
Summer	walk	13/11/2020	18:47	19:46	00:59	00:59
				Grand Total Duration		**06:22**

2.3.5 Bat roosts

Potential bat roosts, including buildings and other infrastructure, were visited and visually inspected during the day for signs of bats. No caves were found on the site, and none are expected within 20 km of the area due to the topography, but the railway cutting across the AOI can create potential artificial roosts. These were inspected for any signs of roosting bats, which included looking for faecal material and acoustic monitoring with a handheld bat detector.

2.4 DATA ANALYSES

2.4.1 Passive song meters

The files produced by the bat detectors were processed using Kaleidoscope Pro v5.4.0 (www.wildlifeacoustics.com). Recordings for all bat detectors were analysed in batches, by running the auto-id and basic cluster analysis in Kaleidoscope Pro. The auto-id feature provides an identification for each call pulse, which can be useful to help identify bat species, but is unsatisfactory due to the absence of a comprehensive bat call library (the classifier only includes 19 bat species in the subregion) and occasional misclassification of species result due to limited training data. The basic cluster analysis attempts to overcome these limitations by grouping calls according to their acoustic properties. Clusters were subsequently identified manually using input from the auto-id feature and by manually verifying the identification against existing published data for bat calls (e.g. Monadjem *et al*., 2020) and assigning all passes within that cluster to that species.

A recording from each cluster was chosen to be used to identify the cluster. During the selection process, multiple calls were examined per cluster to ensure that the chosen call was representative of the cluster. This 'template' call was chosen to minimise its distance to the cluster centre and with good amplitude and low background noise. The best pulse was chosen from the bat pass that showed the highest amplitude and clearest sonograph signature. These calls were exported for comparison in alternative formats. The spectrogram and waveform were compared with that of Monadjem *et al*. (2020), and additional measurable call parameters (e.g. frequency at the knee) were consulted if deemed necessary.

2.4.2 Active transects

All potential calls from bats were investigated using the auto-id feature in Kaleidoscope Pro v5.4.0. However, this auto-identification feature of bat calls was found to be unreliable due to high levels of background noise created by wind and the vehicle and the small sample size does not allow for the use of basic cluster analysis. All recordings were therefore manually investigated to identify any potential bat calls. All bat passes were manually extracted, plotted and identified. The geographic coordinate of each bat pass was obtained by matching the time of the recording with the GPS track time.

2.4.3 Data Processing

Some recording clusters included a combination of two bat species consistently calling together. These clusters were duplicated to allow the calculation of appropriate number of passes per species. Conversely, single files can contain multiple clusters that are identified as the same species. Therefore, any clusters that contained duplicate detection of a species within a single file were removed to avoid overestimation of the number of passes. The recording times for each hour were calculated according to the dawn and dusk times of the location and date where the bat detector was deployed, and used to correct the number of passes for hours that were less than 60 min in duration (MacEwan *et al*., 2020). Incomplete recording hours occurred at dawn and dusk and also if the bat detectors batteries were depleted before they could be replaced (this occurred only very rarely). The mean and median bat passes were calculated in two ways, one to show the hourly activity patterns only, and the other as the standardised bat passes per hour over each night (as per MacEwan *et al*., 2020). The former simply used the corrected number of bat passes per hour, in combination with either the species or the bat detector id, to calculate the median and average bat passes. The latter took the mean number of bat passes per night and divided by the time recorded for that night (in hours), the median and mean number of bat passes were then calculated from all the nights combined (in combination with the other variables).

2.5 IMPACT ASSESSMENT

The impact that the proposed WEF could have on bats in the region will be based on the species found, and if there are any species of conservation concern or endemic species present. In addition, roosting locations will be identified, and a strict buffer zone will be implemented around these. The same will hold true for any freestanding water sources that could be used by bats.

An impact assessment will be completed in the EIA report after the data has been collected for the 12 month preconstruction monitoring, whereas the current scoping report only identifies potential impacts based on the information available. Upon completion of the data collection and analysis phase, defined buffer zones will be developed in accordance with the avoidance mitigation step of the mitigation hierarchy to prevent any potential major impacts on bats. These buffer zones will determine the number and placement of the wind turbines within the project AOI which in turn, will influence the impact analysis.

3 RESULTS

3.1 LITERATURE REVIEW

The ACR (2020) indicated that no bat species have previously been found within 100 km of the proposed site and as such no museum records have been collected for the area. The closest records are *Rhinolophus clivosus* (104 km from site) and *Laephotis capensis* (107 km from site). Based on Monadjem *et al*. (2020), the ACR (2020) and previous surveys conducted for WEFs in the area (Animalia 2011, Animalia 2017), 11 species could potentially occur in the AOI (Table 3-1), all of which are considered to be of Least Concern by the IUCN. Two of these, *Laephotis capensis* and *Tadarida aegyptiaca*, were confirmed on the Khobab WEF site (Animalia, 2011) that was constructed to the north of the Botterblom WEF project AOI, and as such it can be expected that these two species will be found during the current survey. During the survey for the proposed Kokerboom WEF (Animalia, 2017), *L. capensis*, *Miniopterus natalensis* and *T. aegyptiaca* were commonly found in the area. In addition, *Myotis tricolor* and *Eptesicus hottentotus* were detected, but in low numbers. Finally, no nationally recognized protected areas are found within 100 km of the Botterblom WEF project area.

Table 3-1: Species of bats that could potentially occur on the project area.

Species name	Common name	Conservation Status	Foraging habits	Risk of Impact[1]
Laephotis capensis	Cape serotine	Least concern	Clutter-edge	Low
Laephotis namibensis,	Namibian long-eared bat	Least concern	Clutter-edge	Low
Rhinolophus clivosus	Geoffroy's horseshoe bat	Least concern	Clutter	Low
Rhinolophus capensis	Cape horseshoe bat	Least concern	Clutter	Low
Cistugo sebrae		Least concern	Clutter-edge	Low
Miniopterus natalensis	Natal longfingered bat	Least concern	Clutter-edge	High
Nycteris thebaica	Egyptian slit-faced bat	Least concern	Clutter	Low
Myotis tricolor	Temminck's myotis	Least concern	Clutter-edge	Medium to high
Eptesicus hottentotus	Long-tailed serotine	Least concern	Clutter-edge	Medium
Tadarida aegyptiaca	Egyptian free-tailed bat	Least concern	Open-air	High
Sauromys petrophilus	Robert's flat-headed bat	Least concern	Open-air	High

3.2 ACOUSTIC MONITORING

3.2.1 Passive monitoring

Five static bat detectors were deployed for the survey, four at 7 m and one at 50 m (Table 2-3). The bat detectors were active for a total of 6 219 hours and captured a total of 1 707 bat passes with a median of 0.26 bat passes per hour (see details for each bat detector in Table 3-2). It must be noted that LSM 1 did not record from the 11 November to 12 December 2020, LSM 2 from 13 to 21 January 2021 and LSM 3 from 8 October to 11 November 2020 (refer to the limitations in section 1.5). Even with the downtime on the bat detectors, they recorded data for more than 75% of the time and as such comply with the minimum requirements regarding duration recorded (MacEwan *et al*., 2020).

Table 3-2: Summary bat recording data for each of the deployed bat detectors.

Bat Detector ID	Microphone Height	Total bat passes	Time recorded (hours)	Median bat passes/hour	Average bat passes/hour
LSM1	50 m	498	1146	0.70	1.91
LSM2	7 m	472	1060	0.61	1.69
LSM3	7 m	43	1096	0.10	0.20
LSM4	7 m	167	1454	0.09	0.32
LSM5	7 m	487	1462	1.05	1.43

[1] MacEwan *et al*., 2020

[2] EPTHOT: *Eptesicus hottentotus*, LEONAM: *Laephotis namibensis*, SAUPET: *Sauromys petrophilus*, TADAEG: *Tadarida aegyptiaca* ,

3.2.1.1 Passes by Song Meter

Activity increased steadily after sunset and was highest between 21:00 and 3:00 (Figure 3-1). Bat activity tends to be high in the period directly following sunset due to bats leaving their roosts, and the pattern observed here could suggest that bats do not roost on the project AOI but take some time to reach the area from roosts that are located further away. This is, however, currently only speculation based on overall activity observed and should not be considered conclusive. The mean and median monthly recordings of hourly bat passes per microphone were 1.12 (range: 0.20-1.91) and 0.39 (range: 0.09-1.05) respectively. LSM 1, 2 and 5 had a peak in bat activity during November (Figure 3-2). This could indicate that bats move through the area during that time, using the eastern section on the proposed area as a fly through. Mortality of bats at WEF have also been correlated with insects migrating through an area at height (Rydell *et al*. 2010), and this could be a possibility for the peak in activity observed during November. Seasonal activity was higher during spring than summer (Figure 3-3), suggesting that bats move out of the area, or forage elsewhere, during the dry summer months, and that there are no breeding colonies present on the project area, but additional data from the autumn and winter months will help test this hypothesis. Based on the SABPG (MacEwan *et al*., 2020) for the Nama Karoo Shrublands ecoregion, analogous to the Gariep Karoo ecoregion as defined by Dinerstein *et al.* (2017; see Figure 1-3), a median of between 0.18 and 1.01 bat passes per hour classifies as a Medium Risk for fatalities and above 1.01 as a High Risk

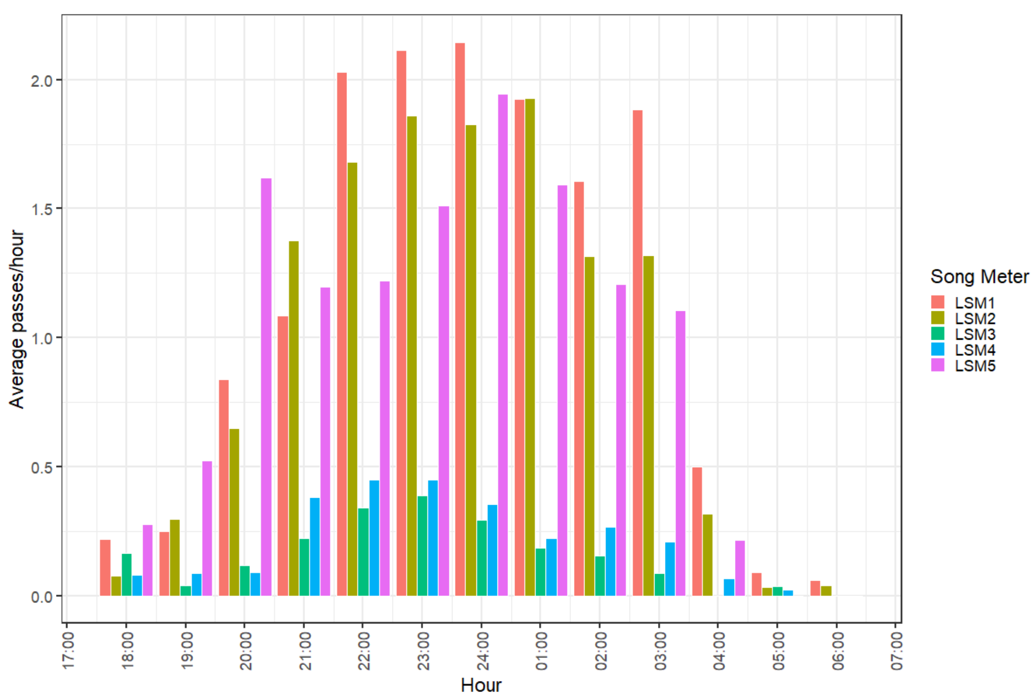

Figure 3-1: Hourly mean activity of bats per bat detector.

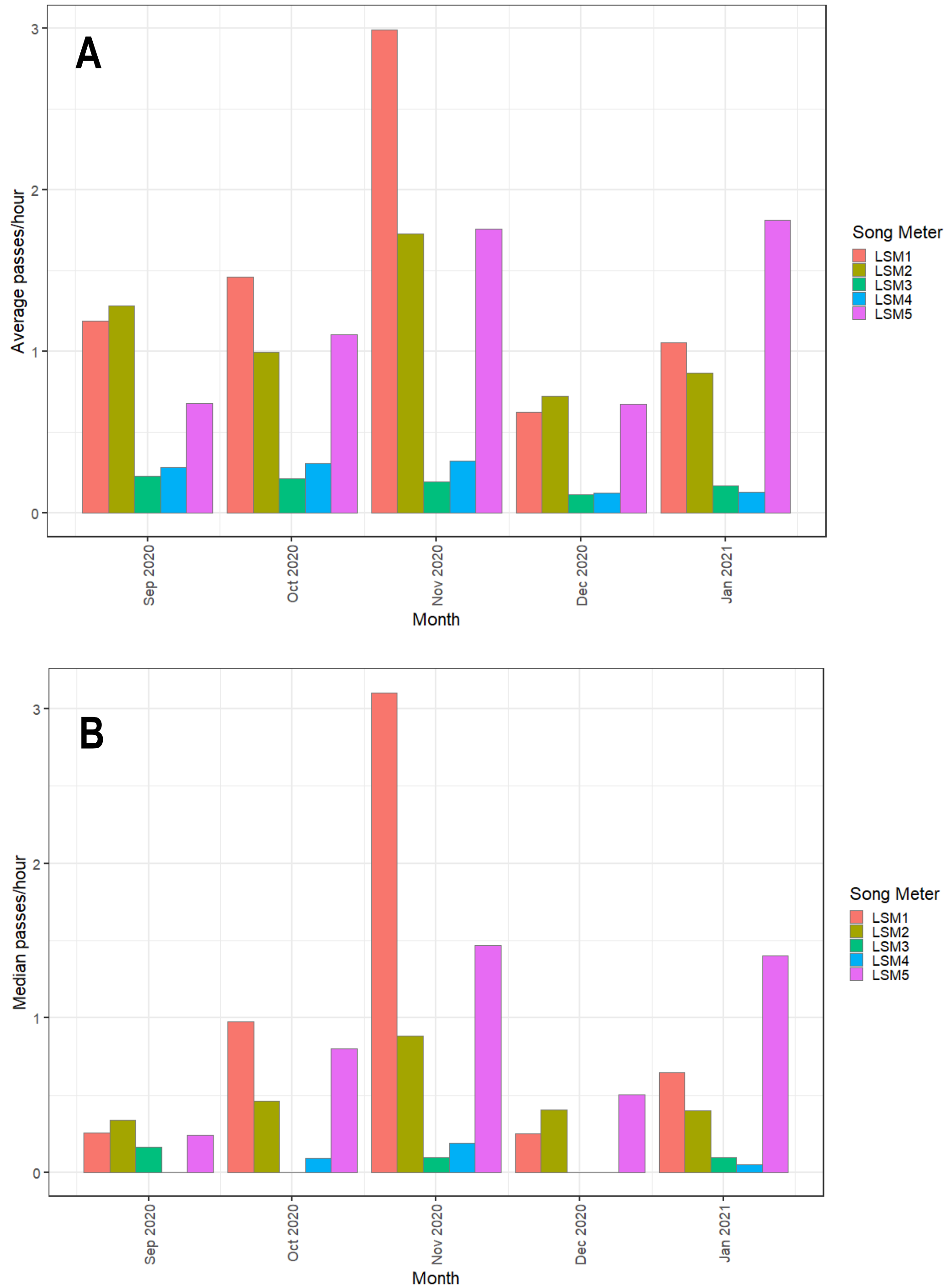

Figure 3-2: Monthly recordings of echolocation calls of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour.

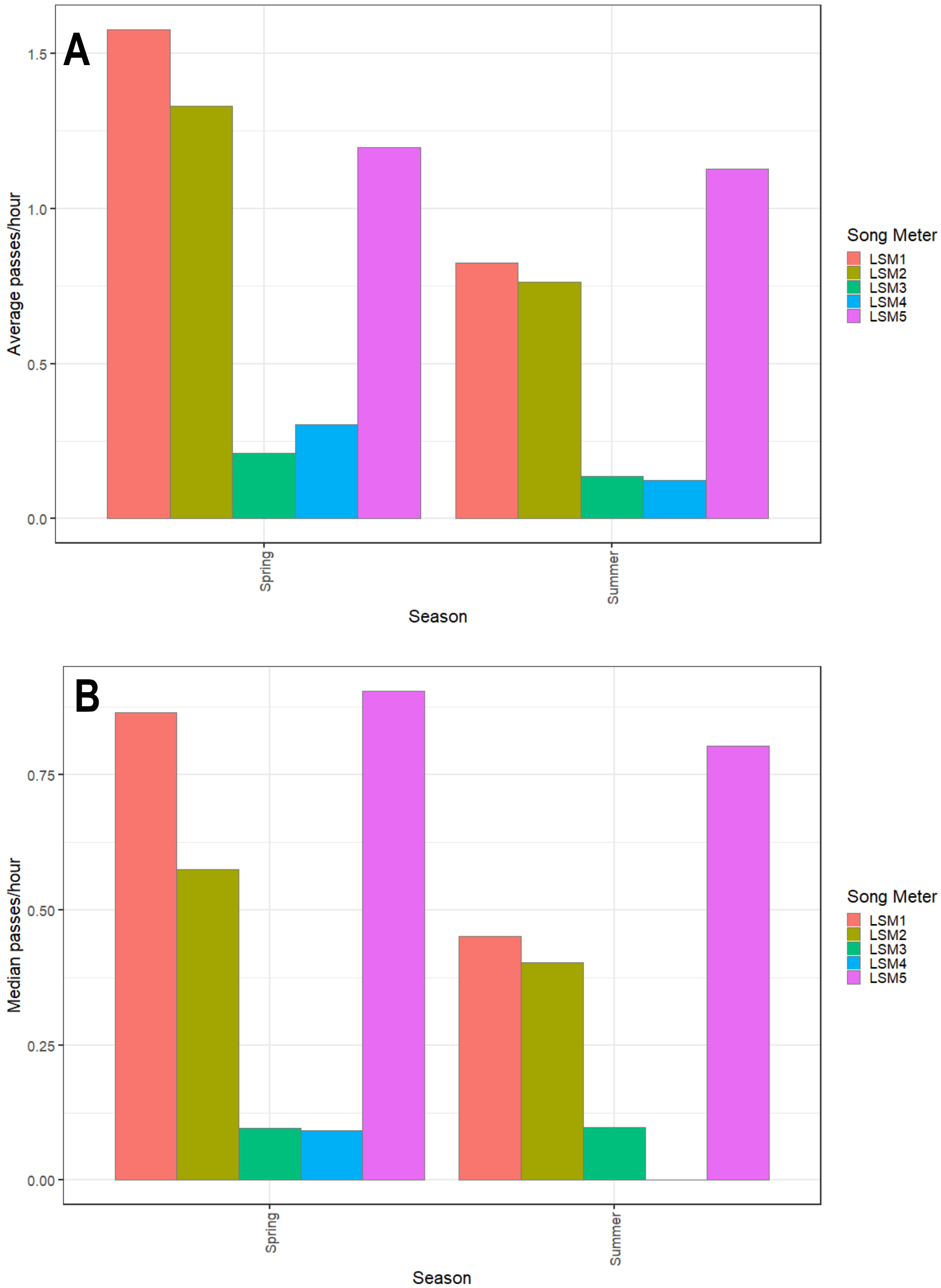

Figure 3-3: Mean seasonal recordings of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour.

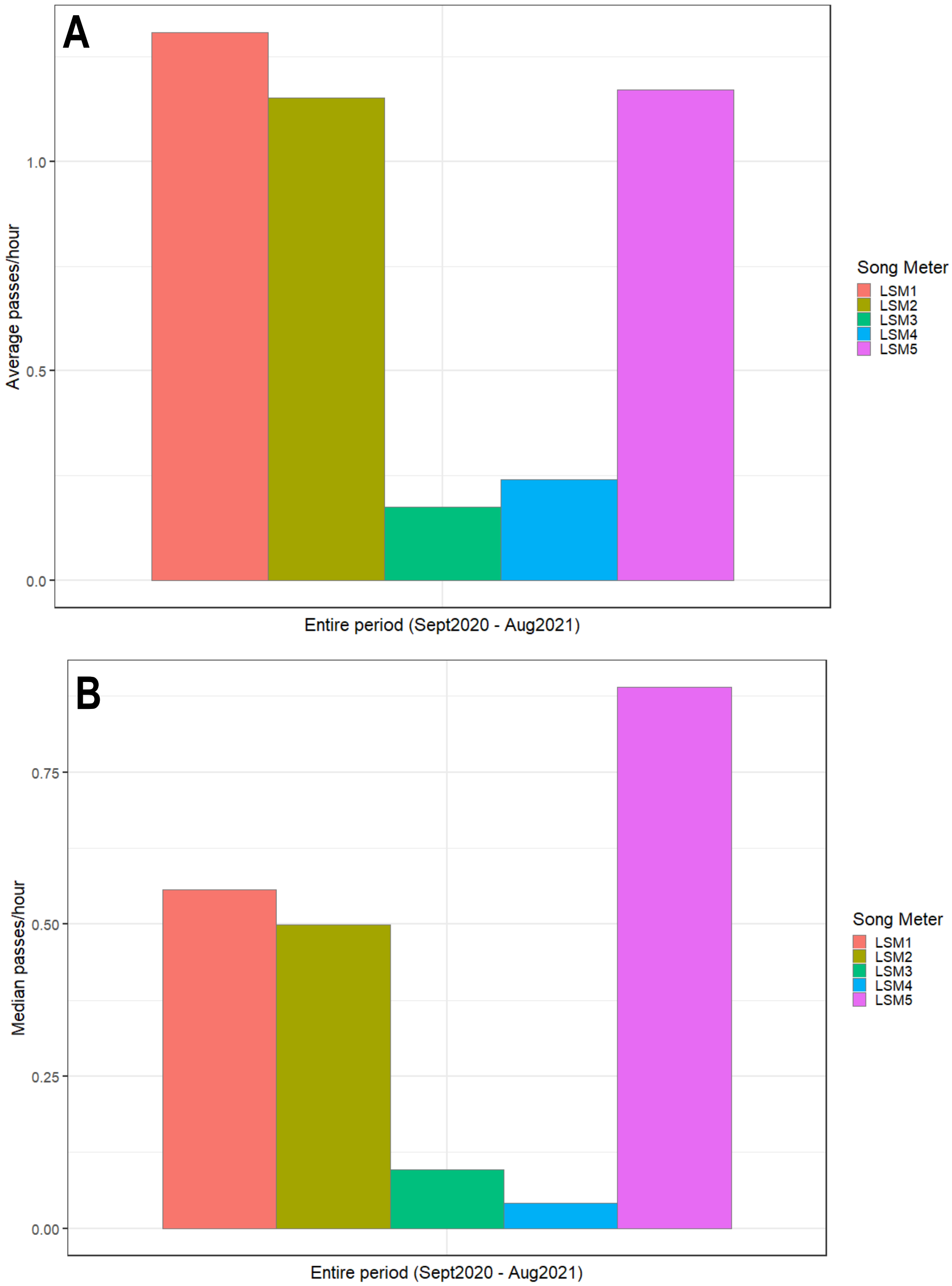

Figure 3-4: Mean yearly recordings of echolocation calls of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour. Note that currently the data for this period only include recordings from Sep 2020 – Jan 2021.

3.2.1.2 Passes by species

Four bat species were recorded by the bat detectors during the Sep 2020 – Jan 2021 survey period (Table 3-3), all of which are listed as Least Concern on the IUCN Red Data List, are not regarded as ToPS species, are not CITES listed and are not endemic to South Africa (IUCN, 2020). Two of these species were represented by only three call recordings in total, and a more comprehensive data set (following completion of sampling) will reveal more about their activity. *Tadarida aegyptiaca* was the most common bat species recorded with a total of 1488 passes and a median of 0.7 passes per hour, followed by *S. petrophilus* with a total of 176 passes and a median of 0 passes per hour (Table 3-4). Both are open-air foragers, and this habitat structure thus provides excellent foraging opportunities for these species. *Eptesicus hottentotus* and *L. namibensis* are clutter-edge foragers, and the lack of a more complex vegetation structure does not suite their foraging requirements. As such it is expected that their presence in the project area will be limited. All four of these species will roost in rock crevices and as such it is expected that they face similar restrictions in terms of roosting habitat available.

Nightly activity patterns of *T. aegyptiaca* shows a similar pattern to that observed in Figure 3-1 with the activity peaking between 22:00 and 24:00. Due to *T. aegyptiaca* being recorded substantially more often than any other species, their activity pattern will strongly influence the collated observed results. Activity of *S. petrophilus* was more intense directly after sunset, indicating that there could potentially be animals roosting on or close to the project AOI (Figure 3-5).

Table 3-3: Confirmed bat species[2] during static monitoring with additional information.

Species	IUCN Red List Status	Likely risk of wind turbine mortality	Endemic
EPTHOT	LC	Medium	No
LEONAM*	LC	Low	No
SAUPET	LC	High	No
TADAEG	LC	High	No

*Recording for LEONAM is tentative and more calls need to be collected to confirm their presence.

Table 3-4: Bat activity during static monitoring for species groups identified from basic cluster analysis[3].

Species	Sum of passes	Median passes/hour	Average passes/hour
EPTHOT	2	0	0.003
LEONAM or TADAEG	1	0	0.001
SAUPET	176	0	0.197
TADAEG	1488	0.314	0.915

[2] EPTHOT: *Eptesicus hottentotus,* LEONAM: *Laephotis namibensis*, SAUPET: *Sauromys petrophilus*, TADAEG: *Tadarida aegyptiaca*
[3] EPTHOT: *Eptesicus hottentotus*, LEONAM: *Laephotis namibensis*, SAUPET: *Sauromys petrophilus*, TADAEG: *Tadarida aegyptiaca*.

Monthly activity patterns show activity levels of *T. aegyptiaca* increasing from September with a peak during November of just over 0.6 passes per hour (median), after which it declines substantially. Activity for *S. petrophilus* is relatively constant across all months (Figure 3-6). Before definite conclusions can be drawn from these data, a full years' worth of data will need to be acquired to further investigate variation in activity which could be indicative of migratory patterns, but the current data would suggest that *T. aegyptiaca* move through the area during November as part of a migratory route, perhaps using it as a resting stop. Considering the heightened activity observed at LSM 1, LSM 2 and LSM 5 during this period it is thus likely that the eastern section forms part of this route. *Tadarida aegyptiaca* do use trees as roosts, and, although no large trees are present, the area around LSM 5 might prove to have sufficient vegetation structure to act as temporary roosts. Seasonal activity of both *T. aegyptiaca* and *S. petrophilus* is higher during spring than summer when considering average passes per hour (Figure 3-7). The overall activity for all bat species reveals that the median is relatively low throughout the year, with less than 0.4 bat pass per night (Figure 3-8), and it was only during November that there were more than one bat pass/hour (median) for, and only for *T. aegyptiaca*.

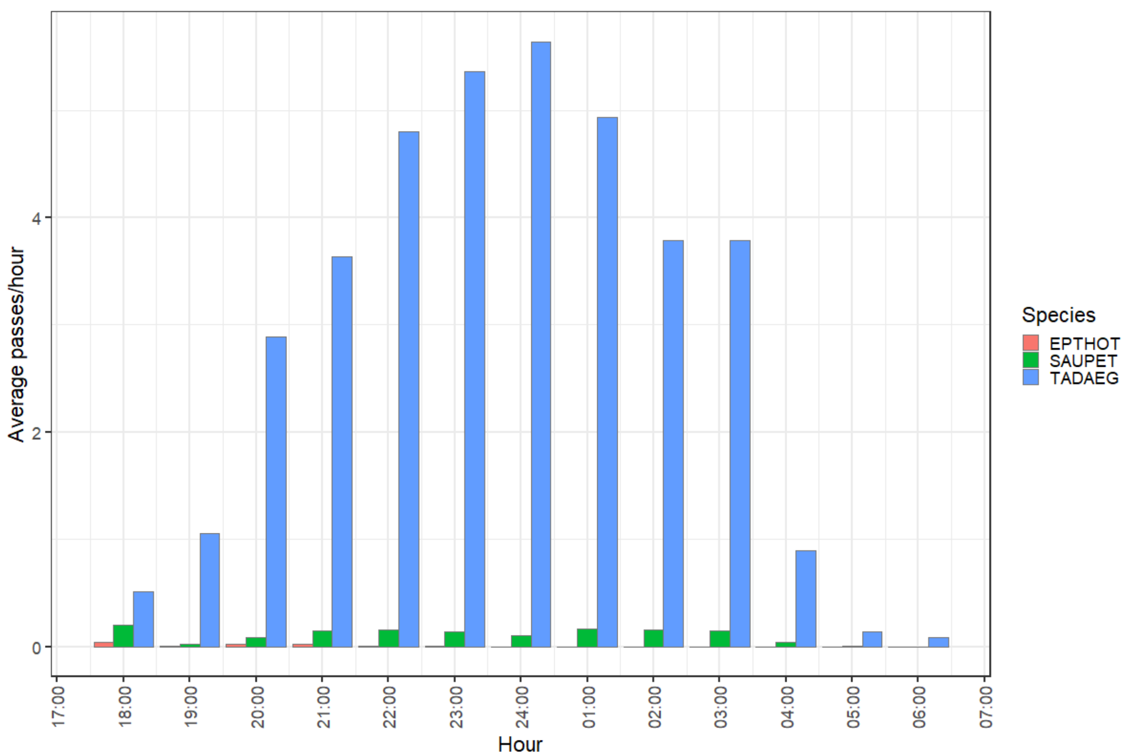

Figure 3-5: Mean hourly active of bats per species (median calculated from sum per hour).

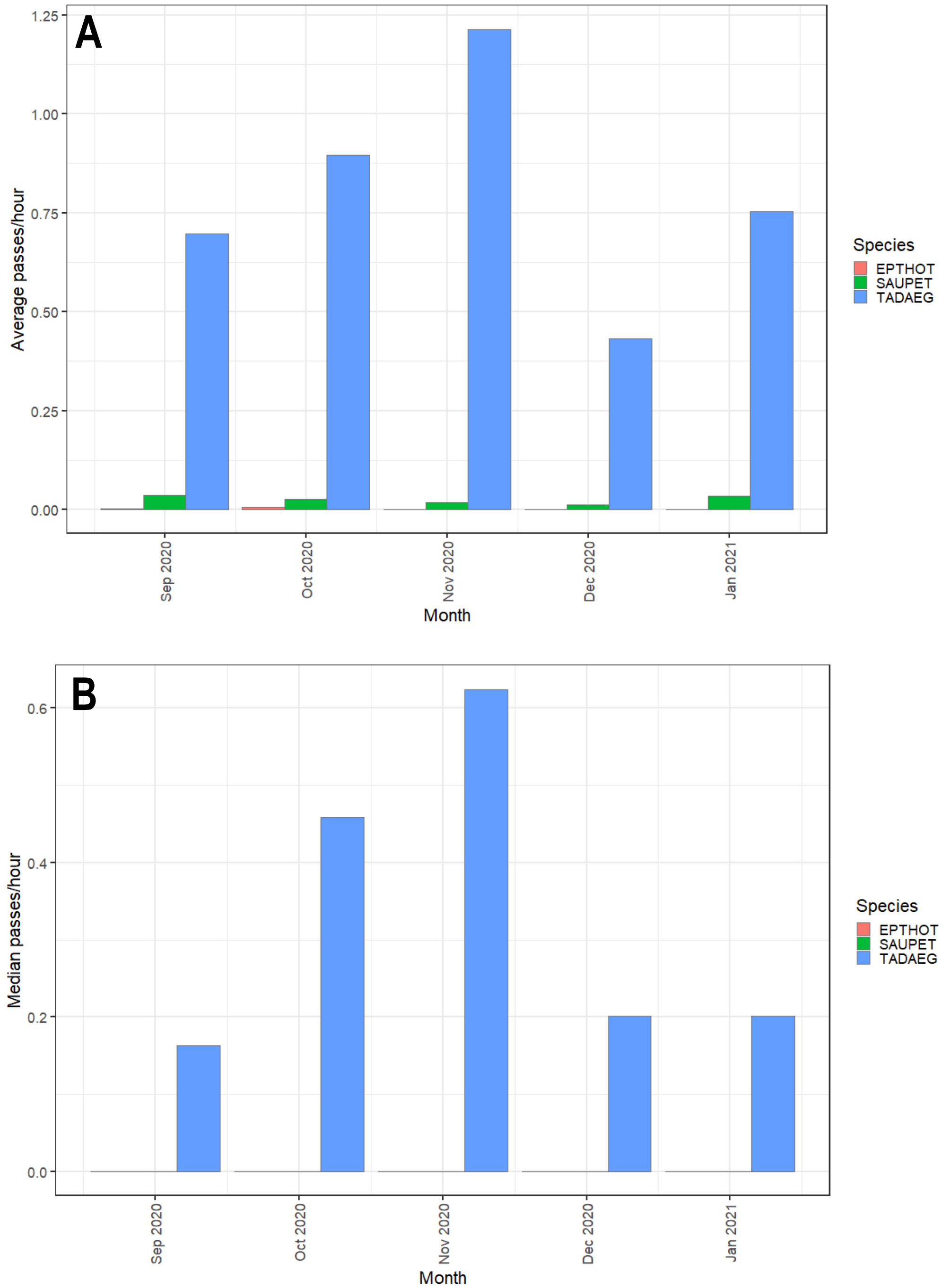

Figure 3-6: Monthly recordings of echolocation calls of bats per bat species (median calculated from sum per night). A] average passes/hour B] median passes/hour.

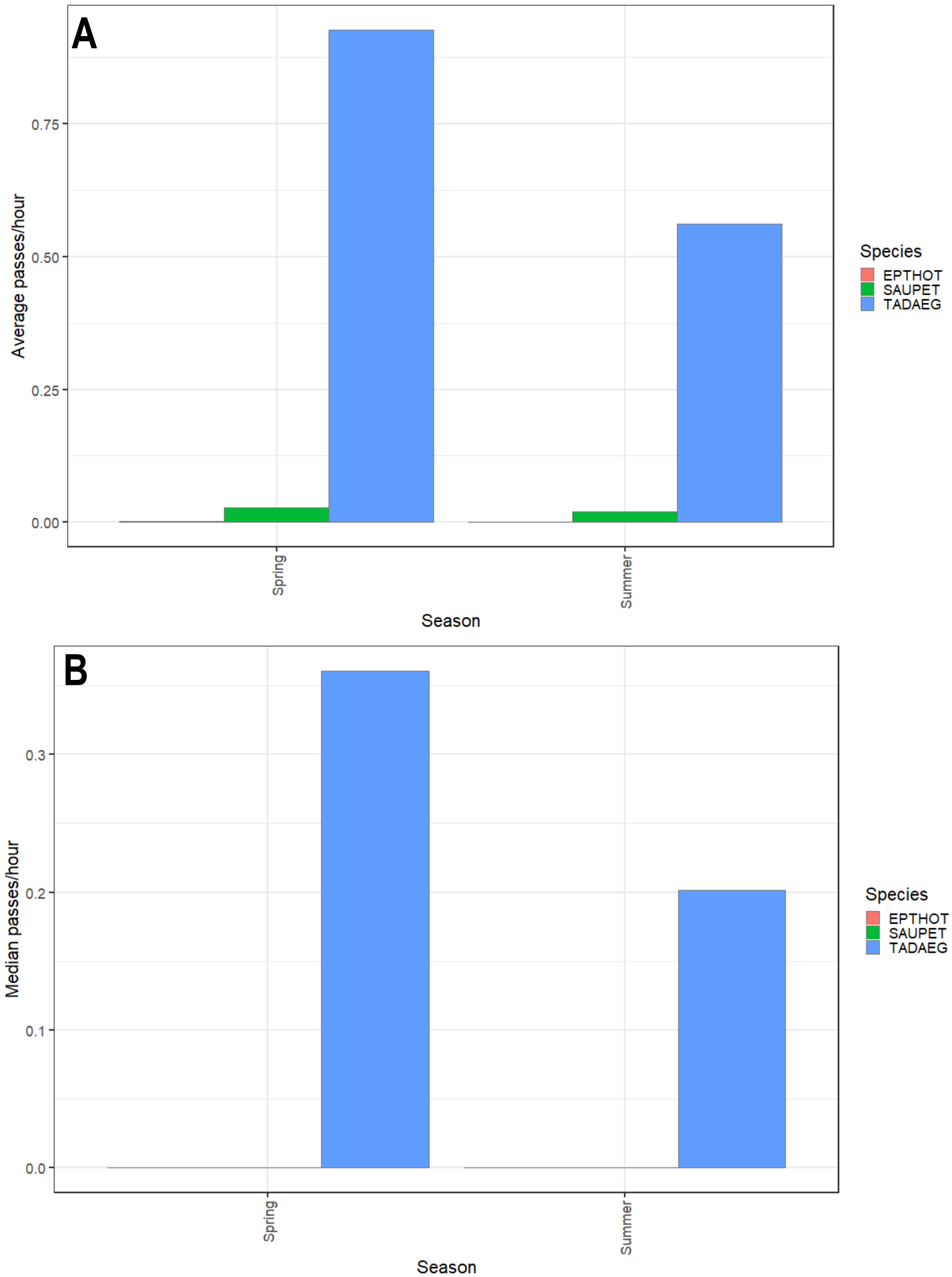

Figure 3-7: Mean seasonal recordings of bats per bat species (median calculated from sum per night). A] average passes/hour B] median passes/hour.

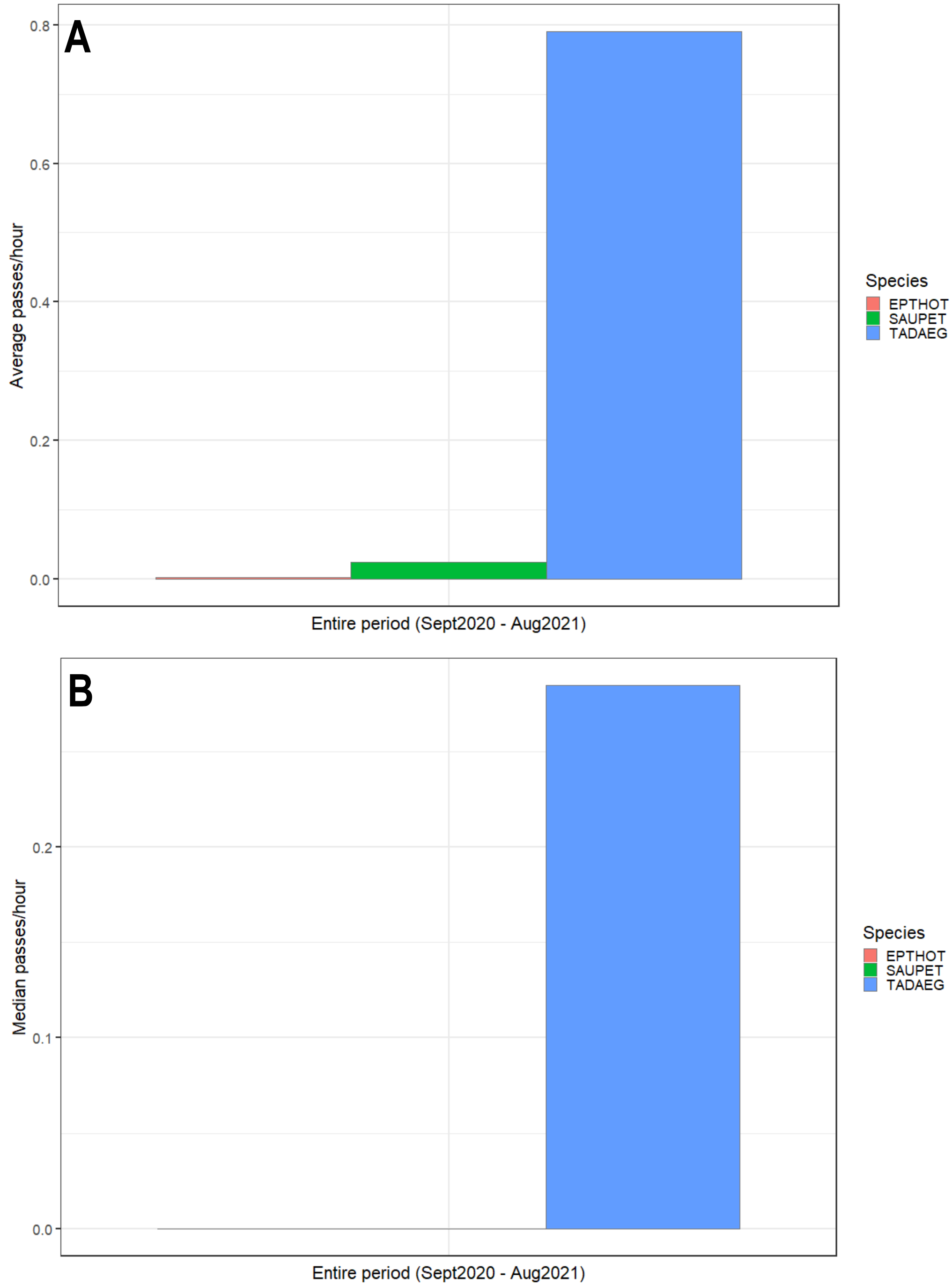

Figure 3-8: Mean yearly recordings of echolocation calls of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour.

3.2.1.3 Passes at height

Bat activity was higher for the microphone at 50 m than the microphones at 7 m when all recorders were considered (Figure 3-9), but similar between the high (LSM1) and low (LSM2) bat detector pair (Figure 3-10). The bat detector placed at 50 m recorded a median of 0.7 passes/ hour, while in comparison, the median for all the combined 7 m bat detectors only recorded 0.30 passes/ hour, and the 7 m microphone at the same geographic location as the 50 m recorded a median of 0.61 passes/hour. This suggests that the location of the bat detector has a greater influence on bat activity recorded than height, and that at this location bats, specifically *T. aegyptiaca* divide their foraging time equally between ground level and at height. The lower activity observed when all bat detectors at ground level is consider is likely an artifact of the lower activity observed in the western section of the proposed area.

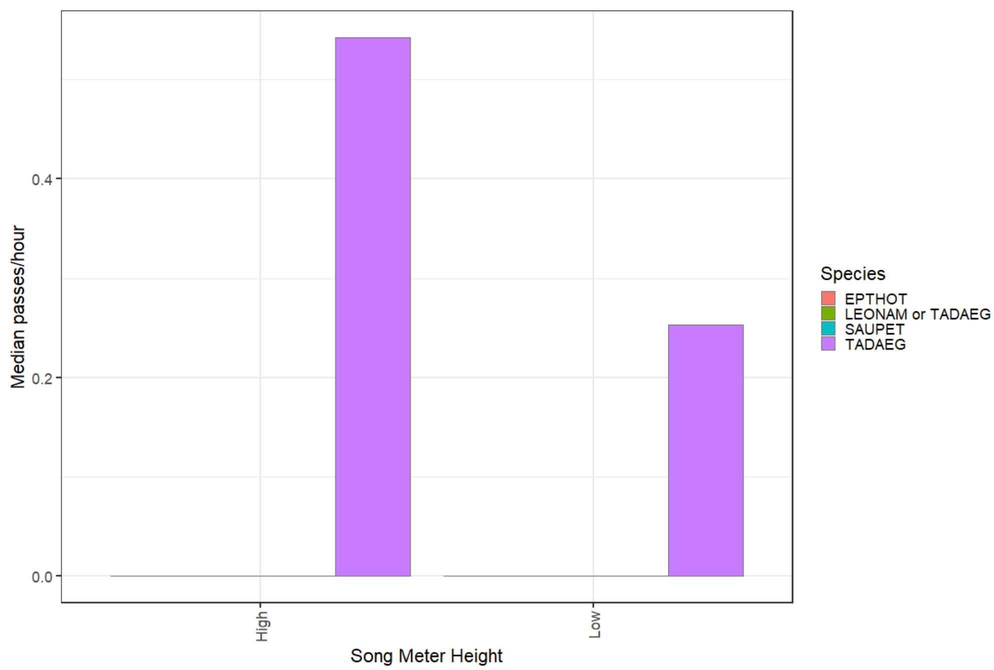

Figure 3-9: Bat activity (passes/hour) comparison between all high and all low song meters (median calculated from sum per night).

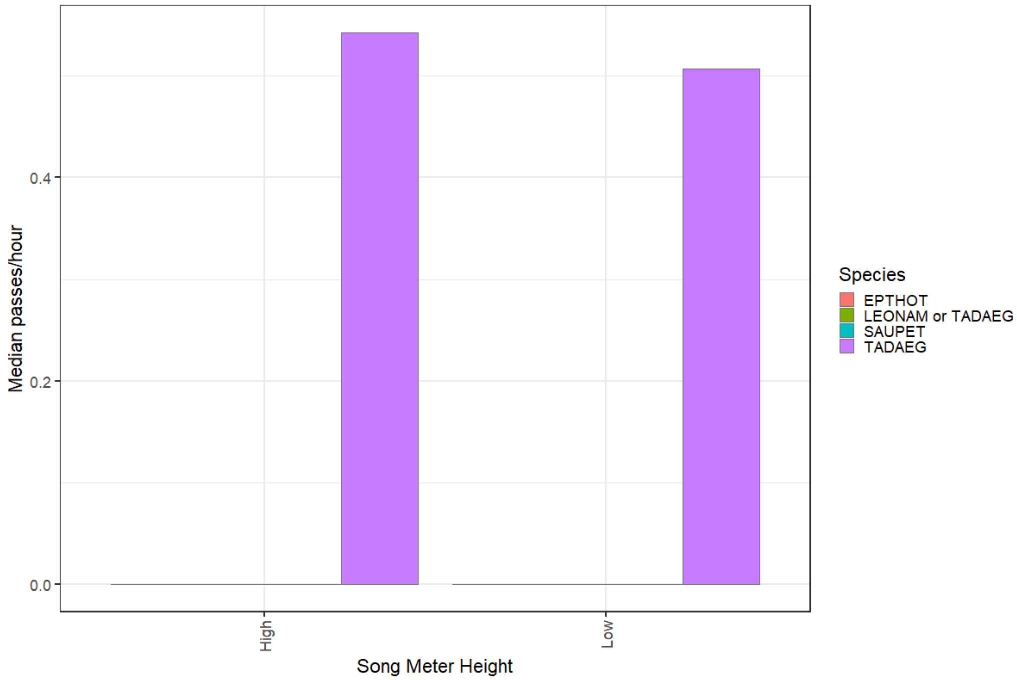

Figure 3-10: Bat activity (passes/hour) comparison between the high (LSM1) and low (LSM2) song meters pair at the same geographic location (median calculated from sum per night).

3.2.1.4 Environmental Variables on bat activity

The client has been requested to provide these data for inclusion on the analyses necessary for the final report. Currently we cannot display these results as we have not been provided the necessary environmental data. However, it has been shown that the activity of insectivorous bats around wind farms, and the subsequent mortality, is higher during lower wind speeds and higher temperatures (Amorim *et al*., 2012), and it is assumed that the same correlations will be seen at the current project area.

3.2.2 Active Monitoring

Three transects were driven across and around the AOI on four nights during November (Figure 3-11). Because roads were limited and portions thereof were driven/walked on multiple nights, transect effort was calculated as the number of times a particular area was covered (Figure 3-11). In total, five echolocation calls were recorded during active monitoring, four of *T. aegyptiaca* and one *L. capensis*, but only two of these were within the AOI, both of which were recorded close to the train tracks transecting the area. *Laephotis capensis* was not recorded on any of the stationary bat detectors indicating very low abundance. It is not a red listed species or endemic to South Africa and is considered by the specialist to be at low risk from turbine related mortality due to them being clutter-edge foragers and not often foraging high above ground level or in the rotor sweep zone.

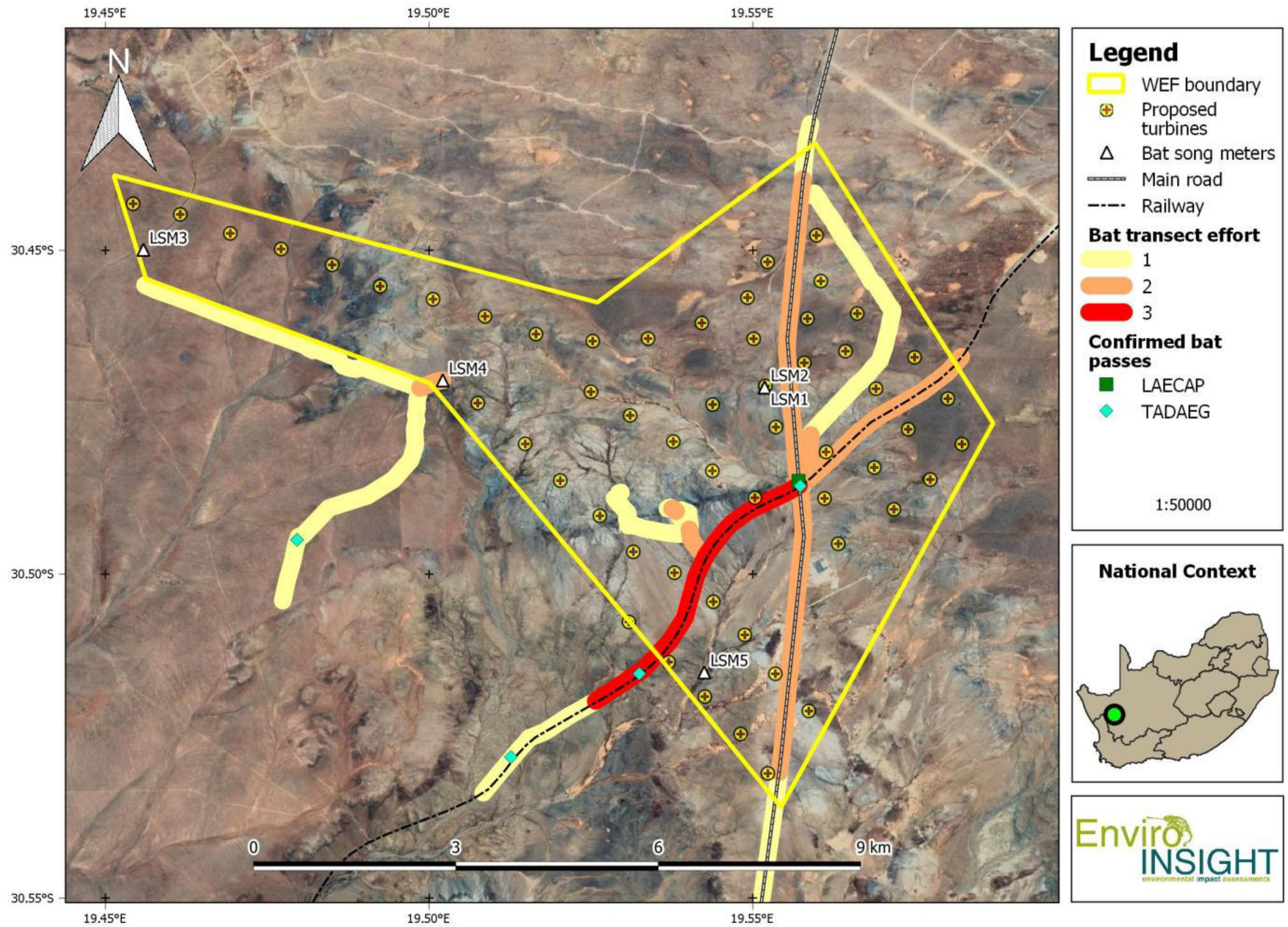

Figure 3-11: The sampling effort of active transects and detection of bat passes during active transects, areas with high sample effort have a proportionally higher likelihood of detecting a bat pass[4].

3.3 ROOSTING SITES

Large structures that have thus far been investigated for large or medium roosts on or near the project area showed no indication of bats present. In addition, the surrounding topography does not lend itself to cave structures and no mention was made of large roosts or caves in any previous surveys. Nine potential roost sites were investigated for the presence of bats, and only one bat was confirmed during day inspections (Table 3-5, Figure 3-12). A single *N. thebaica* was found near a homestead approximately 15 km from the study site. This species was never recorded by the bat detectors, but since they are known as "whispering bats" with low intensity calls this is not surprising (Monadjem *et al*., 2020). An attempt will be made to investigate the four potential roost sites located in the AOI at dusk during future site visits to determine acoustically if bats are present. Considering the species found during passive monitoring, special attention will be given to the railway cut-in (LR4), the abandoned farmhouse (LR5) and the rocky outcrop (LR6) as these are deemed to be the best potential roosting sites for *T. aegyptiaca* and *S. petrophilus*.

[4] LAECAP = *Laephotis capensis*; TADAEG = *Tadarida aegyptiaca*.

Table 3-5: The details of bat roost inspections.

Roost id	Habitat feature	Latitude (°)	Longitude (°)	Date inspected	Observer	Bat presence
LR1	Railway road underpass	-30.486504	19.557184	Dec 2020	Sam Laurence	None
LR2	Railway road overpass	-30.541286	19.490915	Dec 2020	Sam Laurence	None
				Mar 2021	Alex Rebelo	None
LR3	Railway water underpass	-30.503408	19.540763	Mar 2021	Alex Rebelo	None
LR4	Railway in-cut banks	-30.540895	19.491753	Mar 2021	Alex Rebelo	None
LR5	Abandoned farmhouse	-30.47576	19.564543	Dec 2020	Sam Laurence	None
				Mar 2021	Alex Rebelo	None
LR6	Natural rock outcrop	-30.489887	19.537563	Nov 2020	Alex Rebelo	None
LR7	Existing homestead	-30.544862	19.492741	Dec 2020	Sam Laurence	Requires verification
LR8	Existing homestead	-30.59227348	19.69595265	Dec 2020	Sam Laurence	*Nycteris thebaica*
LR9	Existing homestead	-30.59227348	19.67191502	Dec 2020	Sam Laurence	None

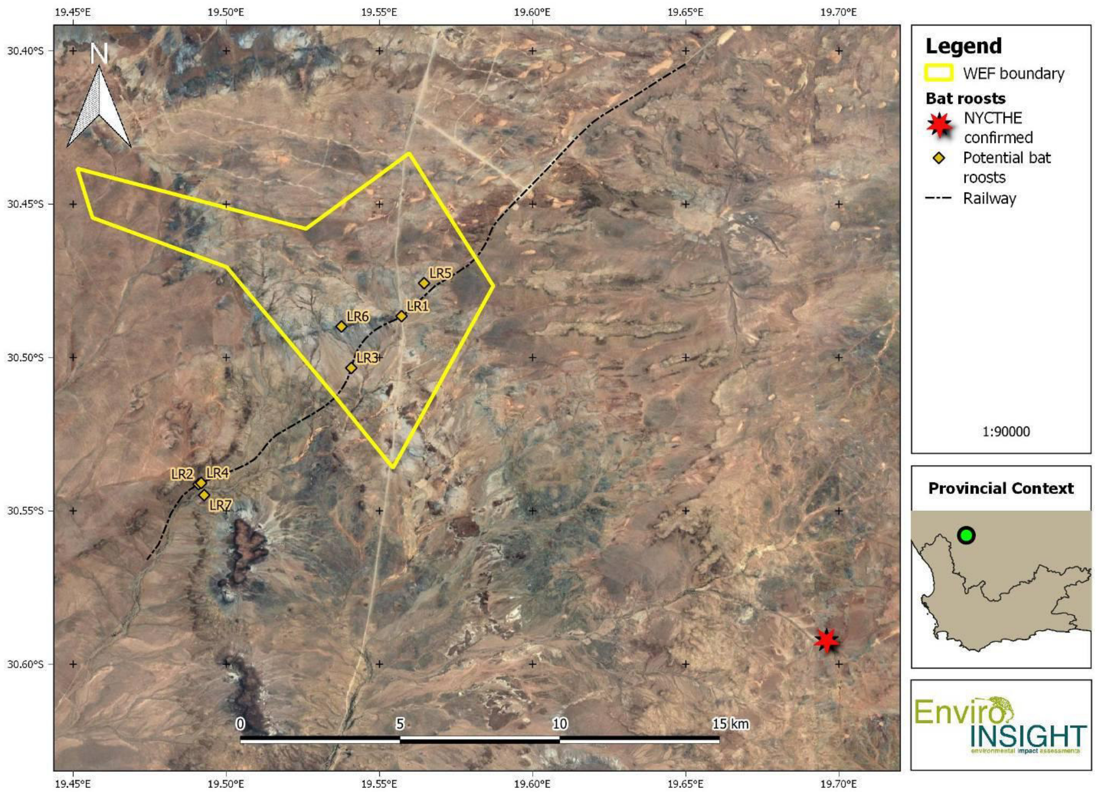

Figure 3-12: Potential roost sites investigated for the presence of bats[5]*.*

3.3.1 Railway roosts

The railway bisects the project area from north-east to south-west and is used for the transport of ore to the coast. Various infrastructure is associated with the railway that includes water underpasses, road underpasses, road overpasses and in-cut banks into the bedrock.

Water underpasses are common along the length of the railway and usually consist of multiple sections of round concrete pipes (Figure 3-13). The seams of the connections between the pipes have a gap that may be suitable for bats to roost, and occasionally open into the foundational rubble under the railway track. A number of these pipes were investigated during the day for bats, but none were observed.

[5] NYCTHE: *Nycteris thebaica*

Figure 3-13: Photographs of the railway water underpasses and features relevant for potential bat roosts.

There is a single road underpass and overpass within and adjacent to the project area which are constructed from concrete and has various seams and cavities that could be used as bat roosts (Figure 3-14; Figure 3-15). No bats were observed within the seams, but the structures could not be comprehensively searched from the ground.

Figure 3-14: Photographs of the railway road underpass and features relevant for potential bat roosts.

Figure 3-15: Photographs of the railway road overpasses and features relevant for potential bat roosts.

In-cut banks that were incised to make the railway level have exposed a shale-like bedrock adjacent to the project area (Figure 3-16). These rock faces are characterised by long, and in some cases, deep cracks and crevices that could be used by bats as roosting sites.

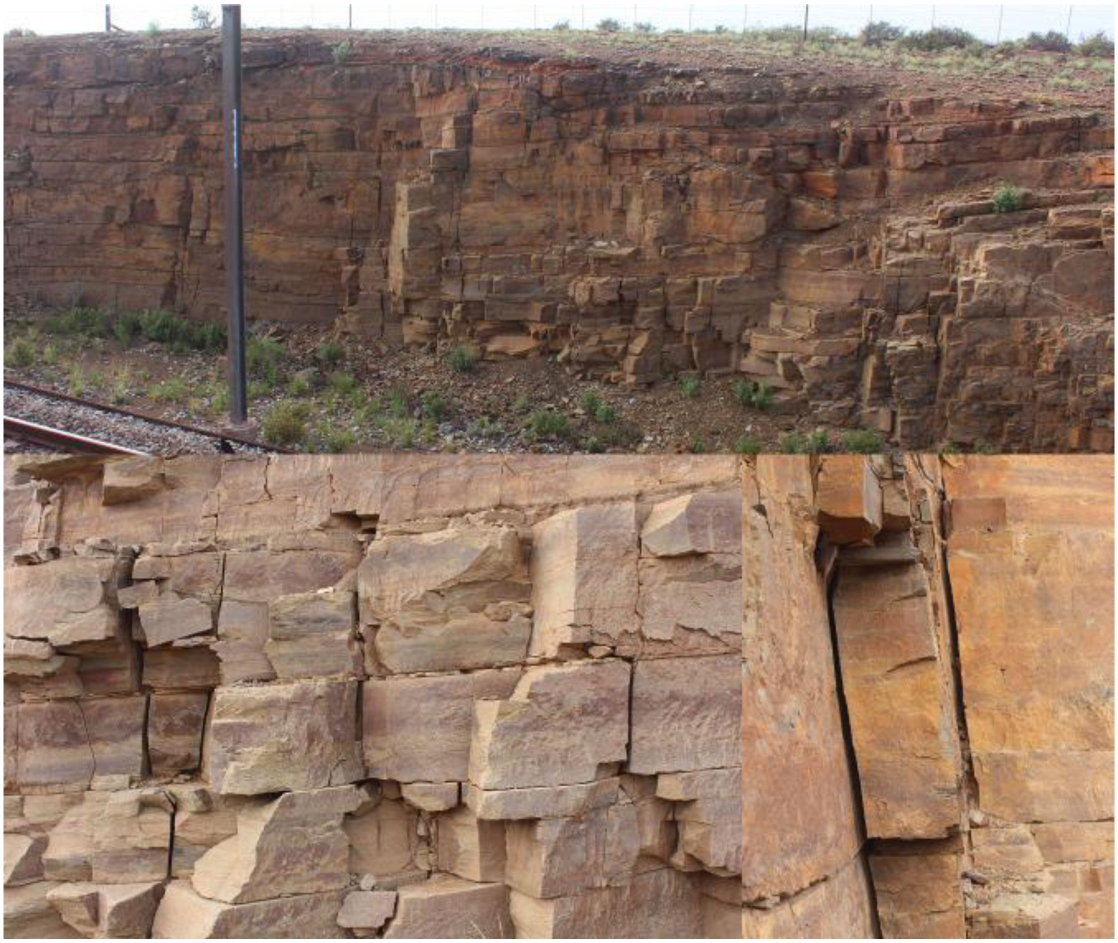

Figure 3-16: Photographs of the railway in-cut banks showing crevices relevant for potential bat roosts.

.

3.3.2 Abandoned / unused farmhouses

Only one abandoned farmhouse is present on the project area in a dilapidated state with little structure. However, there are ceilings in two of the rooms with some gaps that might allow bats to roost (Figure 3-17). The ceilings could not be extensively investigated during the day without destructively sampling the building. However, no obvious signs of bats were present (squeaks, smell, and faeces). Currently, it is not considered to be likely that this represents a large roosting colony. This will be further assessed and monitored by recording echolocations in the autumn and winter season surveys.

Figure 3-17: Photographs of the abandoned farmhouse and features relevant for potential bat roosts.

3.3.3 Existing / used farmhouses

A large homestead approximately 14.9 km west of the project area was identified during the scoping phase (Figure 3-18). It may provide suitable features for roosting bats and will be investigated on upcoming field visits.

Figure 3-18: Aerial image of the homestead showing numerous buildings with potential for providing bat roots. These buildings are approximately 14.9 km west of the project area.

3.4 BAT SENSITIVE FEATURES

Please take note, currently the sensitive areas are only marked without any classification being applied to it. Therefore, no Very High or High sensitive features have been identified as yet. Accordingly, each sensitive feature will still be evaluated based on the complete 12-month data set. Figure 3-19, which represents the preliminary sensitive features identified needs to be carefully interpreted in the absence of a complete data set.

Certain habitats are expected to have a higher abundance of bats due to their potential for roosting, foraging and migration routes. The area in the east where LSM 1, 2 and 5 were placed had much higher bat activity than the bat detectors placed in the western section of the project area. As per the SABPG (McEwan *et al*., 2020) no turbines or any other structure, including infrastructure and major roads, may thus be constructed 200 m around bat sensitive areas. Numerous potential bat roosts and the railway track are located in the eastern section, and as such it is recommended that a 200 m buffer be applied around these potential roosts until it can be confirmed that they are not used as roosting sites by bats (Figure 3-19). Currently a 200 m buffer has been implemented around all water courses which may be altered once the full 12-month survey has been completed. The largest of these water courses, where LSM 5 is located, will, however, have a 200 m buffer which will not be altered. This is due to high bat activity in the area and the presence of trees. The area in the west has relatively little bat activity, and as such the buffers in this area might be removed depending on bat activity during the autumn and winter months. The major water courses, although mostly dry and episodic, nevertheless provide a seemingly greater density of vegetation that remains green for longer than the vegetation of the surrounding plains and therefore, are likely of importance for bats as a foraging resource because vegetation is required for their insect prey to feed on. During the active monitoring, bats were only detected near the railway bridge further confirming this area as sensitive. There is a greater coverage of photosynthetic plants in the western part of the project area during the dry season based on Normalised Difference Vegetation Index (NDVI) mapping (Figure 3-20). This indicates that bat activity does not correspond directly with the presence of any photosynthetic vegetation and that it is likely the specific type of vegetation and its structure that is of relevance to bats. However, a more complete assessment will be made based on a full years' data.

Several of the proposed turbine positions coincide with areas currently classified as sensitive features and consequently may have to be relocated outside of these sensitive areas to minimise potential negative impacts.

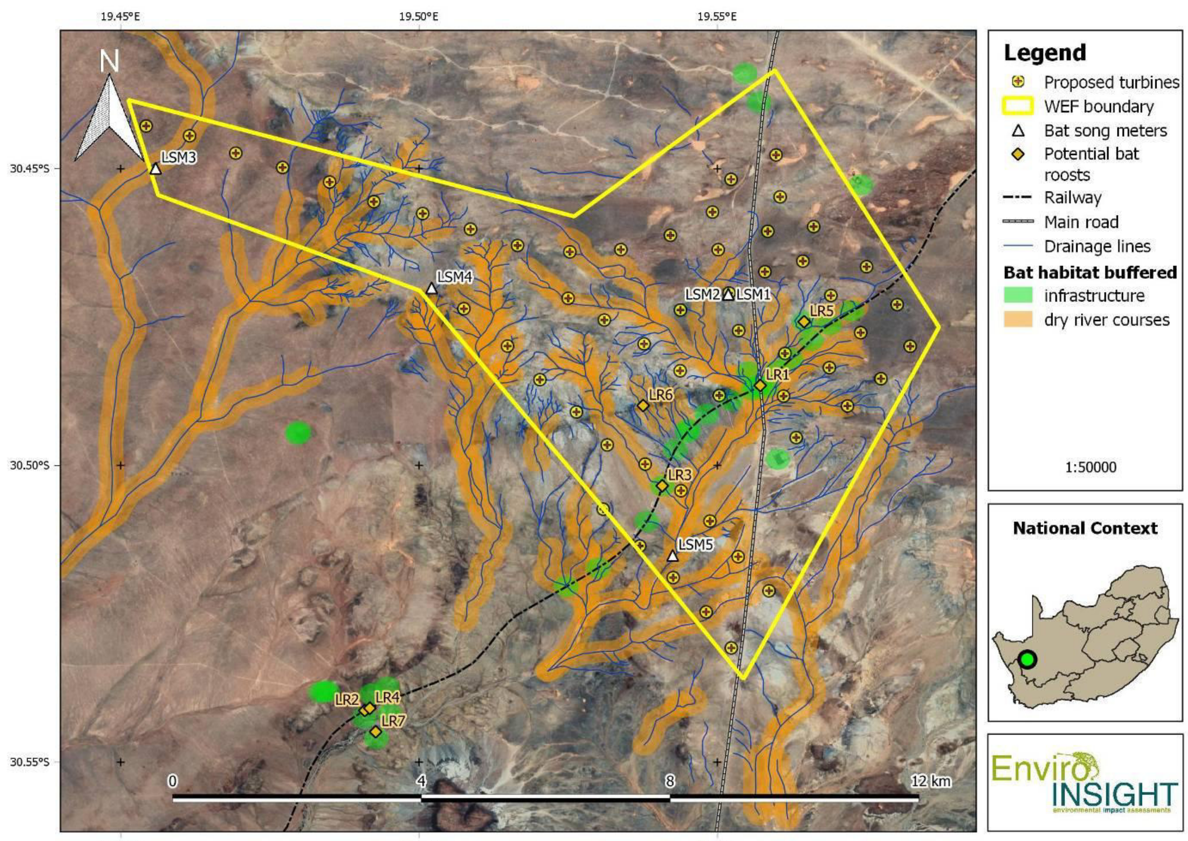

Figure 3-19: Preliminary sensitive bat features within the study area showing the appropriate buffers.

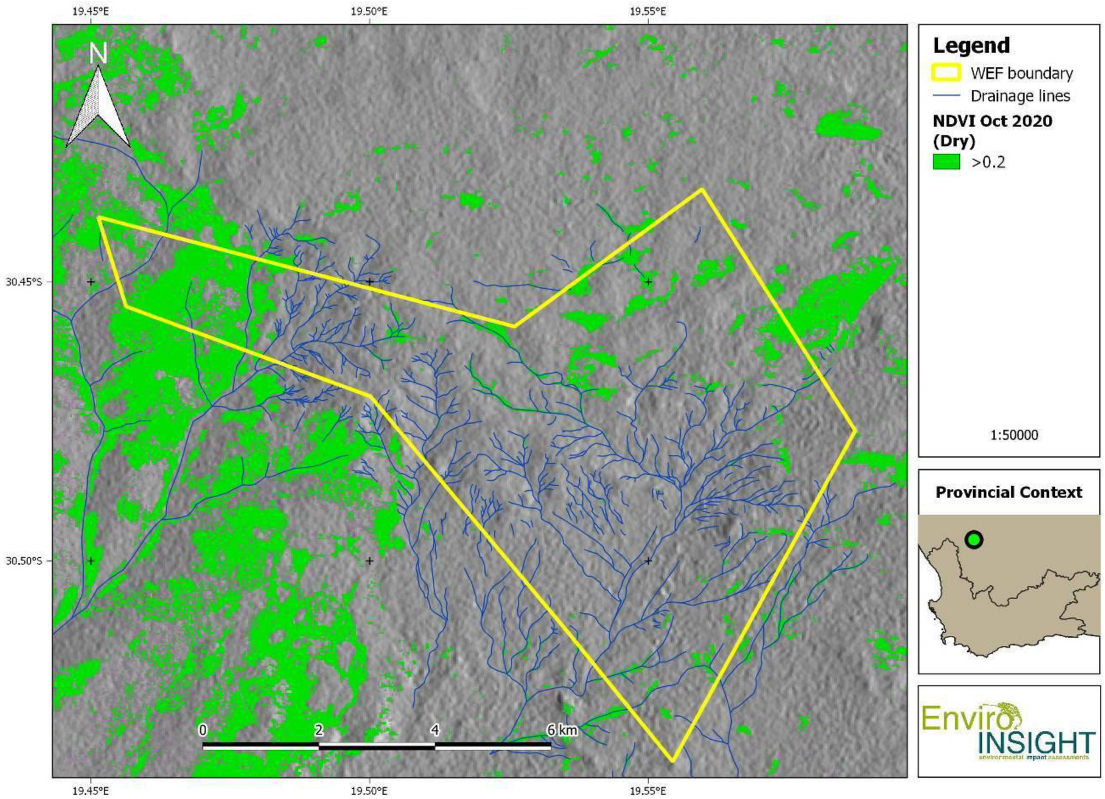

Figure 3-20: Map indicating Normalised Difference Vegetation Index > 0.2 of the area.

4 POSSIBLE IMPACTS

4.1.1 Impacts identified

<u>**Construction Phase:**</u>

- **Habitat destruction:** access roads and turbine or infrastructure construction may necessitate the removal of foraging habitat and sensitive bat features, such as migratory routes
- **Destruction or disturbance of bat roosts:** access roads and turbine or infrastructure construction may necessitate the removal or disturbance of bat roosts.

<u>**Operational Phase:**</u>

- **Bat mortality**: physical bat strikes and barometric trauma causes by spinning blades of the turbines during the operational phase.
- **Artificial lighting:** Artificial lights can have a negative effect on bat behaviour by affecting flight paths used. On the other hand, bats could be attracted to lights due to higher insect abundance and be at higher risk of collision mortality.
- **Flight/migratory paths**: Turbines placed on pathways used for migration can have severe effects on bats moving through the area during times when bats move to winter/summer roosts.

4.1.2 Proposed Mitigation Measures

Habitat destruction: Apply necessary buffers for roost sites and sensitive bat features, avoiding the construction of turbines and access roads in these areas. Roads must follow existing farm roads as far as possible.

Bat mortality: Avoid placement of turbines near sensitive bat features and roosts, adaptive mitigation measures according to post-construction monitoring results (counted strikes) informed by environmental correlates of bat activity.

Bat collisions: Increase turbine cut in speed as this has been shown to reduce collisions.

Avoidance: It is recommended that NO development (including the full rotor swept zone of wind turbines) takes place in BOTH Very High and High bat sensitivity areas. Take note that these areas still need to be defined and will be shown in the final EIA report. Avoid impacts to natural and artificial wetlands and water bodies by implementing the appropriate buffer areas where no development may take place.

Artificial lighting: With the exception of compulsory civil aviation lighting, minimise artificial lighting at night, especially high-intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights at sub-station, offices and turbines.

Flight/migratory paths: Cut in speeds needs to be increased and possible curtailment during times when bats migrate.

Table 4-1: Potential impacts pre-mitigation and post-mitigation.

Impact	Pre-mitigation (+ / -)	Post-mitigation (+ / -)	Residual impacts	Potential Fatal Flaw
Loss or destruction of foraging habitat	Medium	Medium / Low	No	No
Loss or destruction of bat roosts	Medium	Medium / Low	No	No
Bat mortality	High	Medium	Potentially	Unlikely
Artificial lighting	High	Medium / Low	No	No
Flight/migratory paths	High	Medium	Potentially	Unlikely

4.2 CUMULATIVE IMPACTS

Several renewable energy development applications have been submitted and/or authorised within the immediate area of the proposed Botterblom WEF (Figure 4-1) which will likely already have a negative impact on bats in the region. Considering that there is already two WEFs to the north and north-east of the current site the proposed WEF will add to the impacts currently experienced in the greater area (magnitude currently unknown due to absence of mortality data, see 1.5 Assumptions and Limitations). Furthermore, several additional WEFs are being planned for this area based on approved environmental authorisations. As such, the results obtained during this survey should be considered in conjunction with the impacts created by these WEFs. The bat mortality data from post-construction monitoring of the Khobab WEF has been requested *via* SABAA and will be included in the above evaluation as well as the cumulative impact assessment, once available.

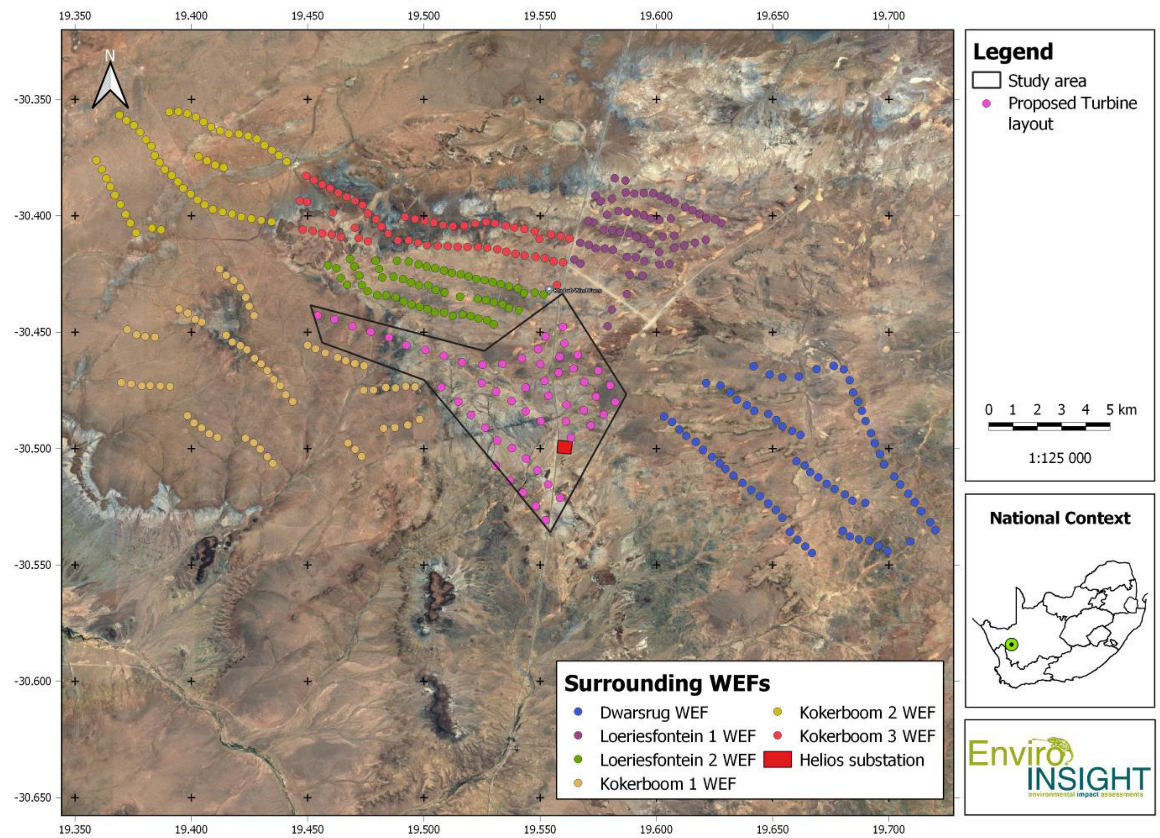

Figure 4-1: Current and proposed WEFs surrounding the proposed Botterblom WEF.

4.3 ENVIRONMENTAL MANAGEMENT PROGRAMME CONDITIONS

A full Environmental Management Programme (EMPr) will be supplied in the final EIA report, but currently it is suggested that all potential bat roosts are avoided until it can be confirmed that these are not in use.

In addition, due to the perceived sensitivity of the river and drainage lines it will be recommended that these are avoided by all activities related to the WEF. Additional conditions will be provided should the final impact assessment reveal the necessity for more specific directives in this regard.

5 DISCUSSION AND CONCLUSION

This scoping report for pre-construction bat monitoring captures data collected from September 2020 to January 2021 wherein data were collected from four 7m masts and one 50 m meteorological mast. A few technical failures occurred during this period; however, these failures should not compromise the findings of this assessment since adequate amount of data were recorded during this period. In addition, the transects and roost inspections for the summer period were conducted with no active roosts found.

A total of five species were detected on the project AOI namely: *T. aegyptiaca, A. petrophilus, E. hottentotus, L. namibensis* and *L. capensis*. Based on the South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy

Facilities (MacEwan *et al.*, 2020) an hourly median of under 0.18 bat passes on the bat detectors placed at ground level is regarded as a Low Fatality Risk and between 0.18 and 1.01 is Medium Risk for the Nama Karoo Shrublands ecoregion. The median bat passes/hour recorded at ground level for LSM 2, 3 and 4 during the current survey was 0.30, qualifying as a Medium Risk for bat mortalities. The median bat passes/hour recorded at 50 m (LSM1) was 0.70, and this potentially indicates a High Risk (> 0.42). However, the peak in activity observed during November influenced the observed data for the entire period, and when the data is considered without this peak the risk is reduced. The completed data set after 12 months will reveal whether there is in fact a high risk of bat collisions across the entire period or if this is only for specific months, but if the risk is only high during specific season's mitigation measures can be put in placed to reduce this risk. In addition, a bat detector has been placed at 100 m during March 2021. Comparisons between the bat detector at 50 m and the one at 100 m will indicate if activity is indeed high within the rotor sweep zone.

Upon completion of the bat monitoring and subsequent updating of the sensitive areas map, the construction layout of the wind turbines and additional infrastructure can commence to avoid all sensitive areas. Currently, the predicted sensitive areas are around the dry riverbeds in the eastern part of the site, but a more comprehensive data set which will be obtained during the upcoming surveys, will provide a better indication of the sensitive areas.

From the available data collected, the construction of a WEF on the proposed AOI will have a Medium-High Risk of impacting the bat population in the area before mitigation measures have been put in place, but this statement is currently only valid for the spring and summer months. Currently, after mitigation measures have been followed this risk will be reduced to Medium. This will be further investigated and discussed in the EIA report. The bat detector placed at 100 m will provide data to make a more informed recommendation and determine whether bat activity is in fact high in the rotor sweep zone. Currently it is suggested that mitigation measures be implemented during the spring and summer months considering the activity levels during this period. These mitigation measures would include a higher cut-in speed as this has been shown to significantly reduce bat mortalities (Arnett *et al.*, 2009) or curtailment during peak activity periods.

6 REFERENCES

African Chiroptera Report. (2020) AfricanBats NPC, Pretoria. i-xv + 8297 pp. doi: 10.13140/RG.2.2.27442.76482

Amorim, F., Rebelo, H., Rodriques, L. (2012) Factors influencing bat activity and mortality at a wind farm in the Mediterranean region. *Acta Chiropterologica*. 14(2: 439 – 457.

Animalia. (2011) Environmental Constraints Analysis with regards to bat (Chiroptera) sensitivity - For the proposed Loeriesfontein Wind Energy Facility near Loeriesfontein, Northern Cape.

Animalia. (2017) Findings of a 12-month Long-Term Pre-Construction Bat Monitoring Study and Impact Assessment for the proposed Kokerboom 1 Wind Farm, Northern Cape. Ref: R-1701-02.

Arnett, E. B., M. Schirmacher, M. M. P. Huso, and J. P. Hayes. (2009) Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N.D., Wikramanayake, E., Hahn, N., Palminteri, S., Hedao, P., Noss, R. and Hansen, M. (2017). An ecoregion-based approach to protecting half the terrestrial realm. *BioScience*. 67(6): 534-545.

IUCN. (2021) The IUCN Red List of Threatened Species. [Online] Available at: http://www.iucnredlist.org

Jacobsen, N.H.G., & du Plessis, E. (1976) Observations on the ecology and biology of the Cape fruit bat *Rousettus aegyptiacus leachi* in the Eastern Transvaal. *South African Journal of Science*. 72. 2

MacEwan, K., Sowler, S., Aronson, J., and Lötter, C. (2020) South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5. South African Bat Assessment Association.

Monadjem, A., Shapiro, J.T., Mtsetfwa, F., Reside, A.E., McCleery, R.A. (2017) Acoustic Call Library and Detection Distances for Bats of Swaziland. *Acta Chiropterologica*, 19(1):175-187.

Monadjem, A., Taylor, P., Cotterill, F., Schoeman, M. (2020) *Bats of Southern and Central Africa: A biogeographic and taxonomic synthesis, second edition*. Johannesburg: Wits University Press. doi:10.18772/22020085829.

Mucina, L. & Rutherford, M.C. (Eds.) (2010) The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria.

Olson, D., Wikramanayke, E., Burgess, N.D., Dinerstein, E. (2001) Terrestrial ecoregions of the world: A map of life on earth. *Bioscience*. 51(11): 933-938

Pretorius, M., Broders, H., Seamark, E. and Keith, M. (2020) Climatic correlates of migrant Natal long-fingered bat (*Miniopterus natalensis*) phenology in north-eastern South Africa. *Wildlife Research* 47(5), 404-414. doi.org/10.1071/WR19165

Rydell, J., Bach, L., Dubourg-Savage, J., Green, M., Rodrigues, L., Henderstrom, A. (2010) Mortality of bats at wind farms links to nocturnal insect migration. *Europena Journal of Wildlife Research*. 56: 823 – 827

South African National Biodiversity Institute. (2018) Beta Vegetation Map of South Africa, Lesotho and Swaziland (File Geodatabase) [File geodatabase] 2018. Available from the Biodiversity GIS website (http://bgis.sanbi.org/SpatialDataset/Detail/670).

7 APPENDIX

7.1 APPENDIX 1: SPECIALISTS PROOF OF QUALIFICATION

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Low de Vries

Registration Number: 124178

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Zoological Science (Professional Natural Scientist)

Effective **13 November 2019** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Samuel David Laurence
Registration number: 400450/13

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule I of the Act)

Zoological Science	20 November 2013
Ecological Science	20 November 2013

20 November 2013
Pretoria

President

Executive Director

THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Luke Verburgt
Registration number: 400506/11

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Zoological Science **02 November 2011**

2 November 2011
Pretoria

President

Chief Executive Officer

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Alexander Douglas Rebelo

Registration Number: 124030

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Zoological Science (Candidate Natural Scientist)

Effective **11 September 2019** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code