Appendix G.13

BAT IMPACT ASSESSMENT

Public

Bat Pre-Application (Scoping) Impact Assessment Report

For the proposed Igolide Wind Farm, Gauteng, South Africa

Compiled by

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June 2023

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For:	Bat Scoping Assessment report for the proposed Igolide wind farm

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Applicable Legislation

Legislation dealing with biodiversity applies to bats and includes the following:

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004; Especially sections 2, 56 & 97). The Act calls for the management and conservation of all biological diversity within South Africa. Bats constitute an important component of South African biodiversity and therefore all species receive attention, in addition to those listed as Threatened or Protected.

THE SOUTH AFRICAN BEST PRACTICE GUIDELINES for preconstruction studies recommends sensitivity map buffer rules and mitigation by avoidance. 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.

THE BAT MORTALITY THRESHOLD GUIDELINES imposes sustainable bat mortality thresholds for operating wind farms, indicating when wind farms need to apply active mitigation measures. MacEwan, K., Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. 2018. South African Bat Fatality Threshold Guidelines – ed 2. South African Bat Assessment Association.

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Table i: Explanation of abbreviations used in this document

Abbreviation	Explanation
ACR	African Chiroptera Report
BESS	Battery Energy Storage System
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
EIA	Environmental Impact Assessment
IRP	Integrated Resource Plan
MM	Meteorological ("Met") Mast
REC	Renewable Energy Complex
REF	Renewable Energy Facility
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SABAA	South African Bat Assessment Association
SEA	Strategic Environmental Assessment
ShM	Short Mast (passive bat detection system)
WEF	Wind Energy Facility
COD	Commercial Operation Date
Bp/h	Bat passes per hour
WEF	Wind Energy Facility

1 OBJECTIVES AND TERMS OF REFERENCE FOR THE STUDY

The objectives and terms of reference for the impact assessment are to provide the following:

- A description of the baseline characteristics and conditions of the receiving environment (e.g., site and/or surrounding land uses including urban and agricultural areas).
- An evaluation of the predicted impacts of the project on the receiving environment.
- Consider and evaluate the cumulative impacts in terms of the current and proposed activities in the area.
- Recommendations to avoid negative impacts, as well as feasible and practical mitigation, management and/or monitoring options to reduce negative impacts that can be included in the EIA phase and Environmental Management Programme.
- A reasoned opinion as to whether the proposed activity, or portions of the activity should continue to the Environmental Impact Assessment phase.

2 INTRODUCTION

This document is the 12-month Pre-construction Bat Scoping Assessment Report for the proposed Igolide Wind Energy Facility (WEF) completed by Animalia Consultants (Pty) Ltd.

2.1 Project description

The proposed Igolide WEF will be operated under a Special Purpose Vehicle (SPV), Igolide Wind (Pty) Ltd. The project developer aims to bid the Igolide WEF into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or a similar procurement programme under the Integrated Resource Plan (IRP).

2.1.1 Site location

The proposed project will be developed within a project area of approximately 680 hectares. Within this project area, the extent of the project footprint will be approximately 130 hectares, subject to finalization based on technical and environmental requirements. The Project is located approximately 6km northeast of Fochville, within the Merafong City Local Municipality in the Gauteng Province.

The project site, including the turbine locations, is indicated in **Figure 2.1**. The details of the properties associated with the proposed Project, are outlined in **Table 2.1**.

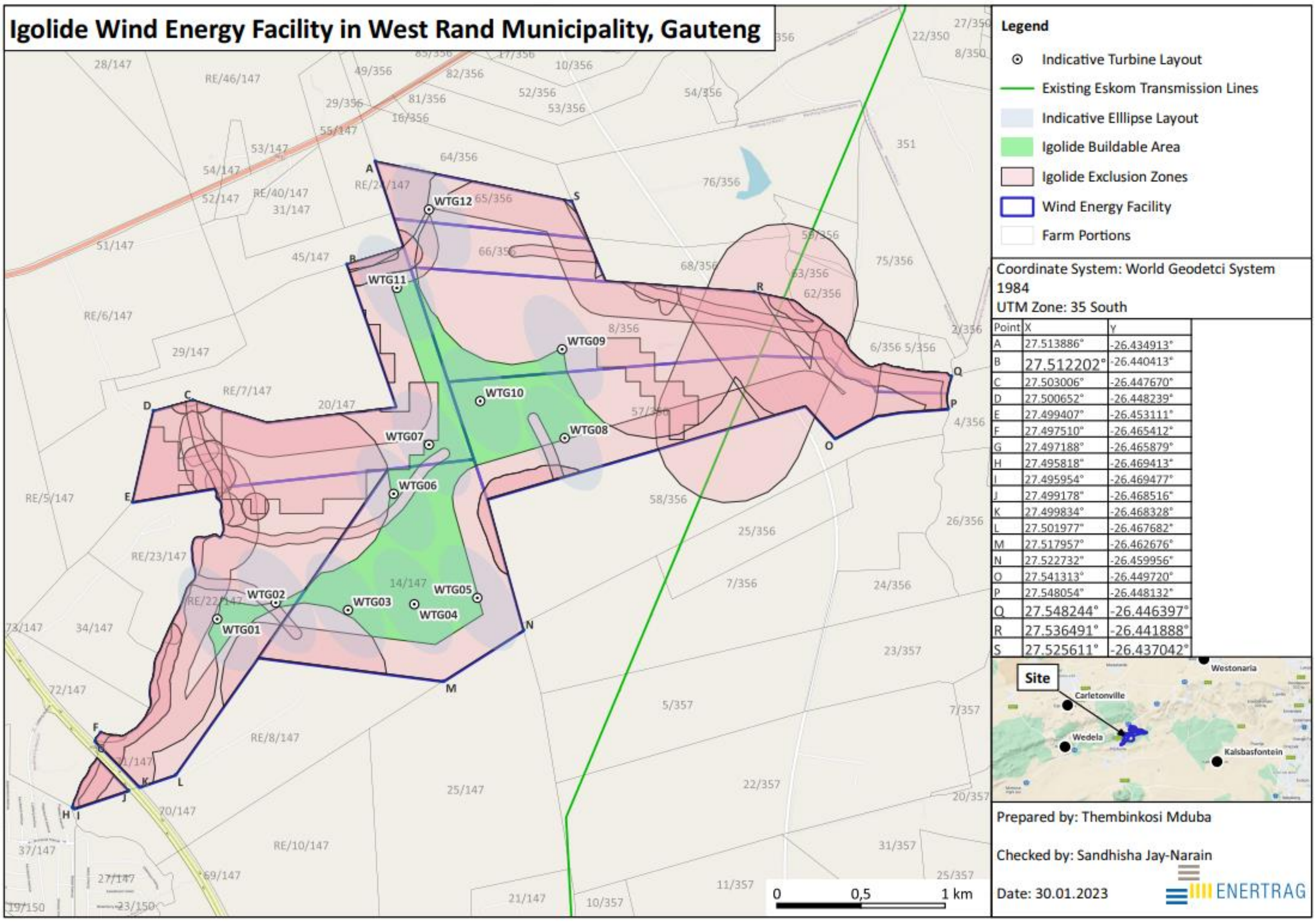


Figure 2-1: Map overview of the position of the proposed Igolide Wind Farm.

2.1.2 Technical details

Table 2-1: Summary of the components, specifications, and approximate areas of impact of the Igolide Wind Farm based on a maximum of 12 turbines.

Facility Name:	Igolide Wind Energy Facility (WEF)
Applicant:	Igolide Wind (Pty) Ltd
Municipalities:	Merafong City Local Municipality in the Gauteng Province of South Africa
Extent:	680ha
Capacity:	Up to 100MW
No. of turbines:	12
Turbine hub height:	Up to 200m
Rotor Diameter:	Up to 200m
Tip Height:	Up to 300m

Foundation:	Approximately 25m diameter x 3m deep – 500 m^3 – 650m^3 concrete. Excavation approximately 2 200m^3, in sandy soils due to access requirements and safe slope stability requirements.
Turbine Hardstand:	Hardstands do not require concrete. Area required will be approximately 1ha per turbine .
Tower Type	Steel or concrete towers can be utilised at the site. Alternatively, the towers can be of a hybrid nature, comprising concrete towers and top steel sections.
On-site IPP substation and battery energy storage system (BESS):	Total footprint will be up to 4ha in extent. The on-site IPP portion substation will have a footprint of approximately 2ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, and other substation components, as required. A 500m buffer around the on-site IPP substation has been identified to ensure flexibility in routing the powerline. The Battery Energy Storage System (BESS) footprint will be up to 2ha. The BESS storage capacity will be up to 100MW/400 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction ("EPC") procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled.
Grid (to form part of a separate application for EA)	A single or double circuit 132kV overhead powerline and 132kV switching station (adjacent to the on-site IPP substation) to feed the electricity generated by the proposed WEF into Eskom's Midas Main Transmission Substation via a 11km overhead line. A corridor of up to 250m in width (125m on either side of the centre line) has been identified for the placement of the up to 132kV single or double circuit power line to allow flexibility in the design of the final powerline route, and for the avoidance of sensitive environmental features (where possible).
Cables:	The medium voltage collector system will comprise cables up to and including 33kV that run underground, except where a technical assessment suggests that overhead lines are required, connecting the turbines to the on-site IPP.

Operations and Maintenance (O&M) building footprint:	Operations and Maintenance ("O&M") building footprint to be located near the on-site substation. Typical areas include: Conservancy tanks with portable toilets. Typical areas include: - Operations building – 20m x 10m = 200m^2 - Workshop and stores area – of ~300m^2 - Refuse area for temporary waste storage and conservancy tanks to service ablution facility. The total combined area of the buildings will not exceed 5 000m^2.
Construction camps:	Typical area of 0.5ha. Sewage typically septic tanks and portable toilets.
Temporary laydown or staging areas:	Typical area of 2ha. Could increase to 3ha for concrete towers, should they be required. Will include diesel, cement and chemical storage, as well as a small workshop area.
Cement Batching Plant (temporary):	Footprint of 1 – 3ha.
Access and Internal Roads:	Internal roads will have a width of 8 - 10m, increasing up to 15m for turning circle/bypass areas to allow for larger component transport. Existing access roads will be used to minimise impact. Where required, the width of the existing roads will be widened to ensure the passage of vehicles.
Supporting Infrastructure:	- Fencing; - Lighting; - Lightning protection; - Telecommunication infrastructure; - Stormwater channels; - Water pipelines; - Offices; - Operational control centre; - Warehouse; - Ablution facilities; - Gatehouse; - Security building; - Visitor's centre; and - Substation building.
Site coordinates (centre point)	26°27'2.44"S / 27°30'58.82"E
Affected farm portion/s	- Portion 14 of Farm 147 Kraalkop - Portion 20 of Farm 147 Kraalkop - Portion RE/22 of Farm 147 Kraalkop - Portion 8 of Farm 356 Leeuwpoort - Portion 57 of Farm 356 Leeuwpoort

	- Portion 65 of Farm 356 Leeuwpoort - Portion 66 of Farm 356 Leeuwpoort

2.2 The Bats of South Africa

Bats form part of the order Chiroptera and are the second largest group of mammals after rodents. They are the only mammals to have developed true powered flight and have undergone various skeletal changes to accommodate this. The forelimbs are elongated, whereas the hind limbs are compact and light, thereby reducing the total body weight. This unique wing profile allows for the manipulation of wing camber and shape, exploiting functions such as agility and manoeuvrability. This adaption surpasses the static design of bird wings in function and enables bats to utilise a wide variety of food sources, including, but not limited to, a large diversity of insects (Neuweiler 2000). Species-based facial features may differ considerably as a result of differing lifestyles, particularly in relation to various feeding and echolocation navigation strategies. Most South African bats are insectivorous and are capable of consuming vast quantities of insects on a nightly basis (Taylor 2000, Tuttle and Hensley 2001) however, they have also been found to feed on amphibians, fruit, nectar and other invertebrates. As a result, insectivorous bats are the predominant predators of nocturnal flying insects in South Africa and contribute greatly to the suppression of these numbers. Their prey also includes agricultural pests such as moths and vectors for diseases such as mosquitoes (Rautenbach 1982, Taylor 2000).

Urban development and agricultural practices have contributed to the deterioration of bat populations on a global scale. Public participation and funding of bat conservation are often hindered by negative public perceptions and unawareness of the ecological importance of bats. Some species choose to roost in domestic residences, causing disturbance and thereby decreasing any esteem that bats may have established. Other species may occur in large communities in buildings, posing as a potential health hazard to residents in addition to their nuisance value. Unfortunately, the negative association with bats obscures their importance as an essential component of ecological systems and their value as natural pest control agents, which actually serves as an advantage to humans.

Many species of bats roost in large communities and congregate in small areas. Therefore, any major disturbances within and around the roosting areas may adversely impact individuals of different communities concurrently (Hester and Grenier 2005). Secondly, nativity rates of bats are much lower than those of most other small mammals. This is because, for the most part, only one or two pups are born per female per annum. Under natural circumstances, a population's numbers may accumulate over long periods of time. This is due to the longevity of up to 30 years (O'Shea *et al*. 2003) and the relatively low predation of bats when compared to other small mammals. However, bat populations are not able to adequately recover after mass mortalities and major roost disturbances.

2.3 Bats and Wind Turbines

Although most bats are highly capable of advanced navigation through the use of echolocation and excellent sight, they are still at risk of physical impact with the blades of wind turbines. The corpses of bats have been found in close proximity to wind turbines and, in a case-study conducted by Johnson *et al*. (2003), were found to be directly related to collisions. The incident of bat fatalities for migrating species has been found to be directly related to turbine height, increasing exponentially with altitude, as this disrupts the migratory flight paths (Howe *et al*. 2002, Barclay *et al*. 2007). Although the number of fatalities of migrating species increased with turbine height, this correlation was not found for increased rotor sweep (Howe *et al*. 2002, Barclay *et al*. 2007). In the USA it was hypothesized that migrating bats may navigate without the use of echolocation, rather using vision as their main sense for long distance orientation (Johnson *et al*. 2003, Barclay *et al*. 2007). Despite the high incidence of deaths caused by direct impact with the blades, most bat mortalities have been found to be caused by barotrauma (Baerwald *et al*. 2008). This is a condition where low air pressure found around the moving blades of wind turbines causes the lungs of a bat to collapse, resulting in fatal internal haemorrhaging (Kunz *et al*. 2007). Baerwald *et al*. (2008) found that 90% of bat fatalities around wind turbines involved internal haemorrhaging consistent with barotrauma.

Three factors need to be present for most South African bats to be prevalent in an area: availability of roosting space, food (insects/arthropods or fruit), and accessible open water sources. However, the dependency of a bat on each of these factors is subject to the species, its behaviour and ecology. Nevertheless, bat activity, abundance and diversity are likely to be higher in areas supporting all three above-mentioned factors. Although bats are predominately found roosting and foraging in areas near trees, rocky outcrops, human dwellings and water; in conditions where valleys are foggy, warmer air is drawn to hilltops through thermal inversion which may result in increased concentrations of insects and consequently bats at hilltops, where wind turbines are often placed (Kunz *et al*. 2007). Some studies (Horn *et al*. 2008) suggest that bats may be attracted to the large turbine structure as roosting spaces or that swarms of insects may get trapped in low pressure air pockets around turbines, also encouraging the presence of bats. The presence of lights on wind turbines has also been identified as a possible cause for increased bat fatalities for non-cave roosting species. This is thought to be due to increased insect activity and subsequent increased foraging activity of bats (Johnson *et al*. 2003). Clearings around wind turbines, in previously forested areas, may also improve conditions for insects, thereby attracting bats to the area. The swishing sound of turbine blades has also been proposed as a possible source for disorientation in bats (Kunz *et al*. 2007). Electromagnetic fields generated by the turbine may additionally affect bats which are sensitive to magnetic fields (Kunz *et al*. 2007). It could also be hypothesized, from personal observations that the echolocation capabilities of bats are designed to locate smaller insect prey or avoid stationary objects, and may not be primarily focused on the detection of unnatural objects moving sideways across the flight path.

A cautionary tale regarding the cumulative impacts that wind energy is able to exert on bat populations is provided through the case study of the hoary bat (*Lasiurus cinereus*). This bat is a common, migratory species across much of the Americas and is currently listed as Least Concern (Gonzalez *et al*. 2016). However, it is also the most frequently encountered victim of fatality around turbine stands in North America. Using population modelling, it has been calculated that hoary bats could decline by as much as 90% over the next 50 years, assuming static population growth rates, and allowing for the current expansion of the wind energy industry in the United States and Canada (Frick *et al*. 2017). There has been an urgent call to curb hoary bat deaths on account of wind farms before the risk of extinction escalates.

South African operational monitoring studies currently point to South African bats being just as vulnerable to mortality from turbines as international studies have previously indicated. The main species of concern are *Laephotis capensis*, *Tadarida aegyptiaca* and *Miniopterus natalensis,* on this site and in general. They will be discussed in depth in this report (Section 4.3). It is important from both a conservation and an ecological standpoint to maintain the abundance of even our common species, especially given the scale of wind energy prospecting occurring in South Africa at present.

Whatever the reason for bat fatalities in relation to wind turbines, it is clearly a significant ecological problem which requires attention. Most bat species only reproduce once per year, bearing one young per female, thus their numbers are slow to recover from mass mortalities. It is very difficult to assess the true number of bat deaths in relation to wind turbines, due to carcasses being removed from sites through predation, the rate of which differs from site to site as a result of habitat type, species of predator and their numbers (Howe *et al*. 2002, Johnson *et al*. 2003). Various mitigation measures are being researched and experimented with globally. The implementation of curtailment processes, where the turbine cut-in speed is raised to a higher wind speed, has been proven to be the most effective mitigation measure currently. This relies on the principle that the prey of bats will not be found in areas of strong winds and more energy is required for the bats to fly under these conditions anyways. The impact on bats foraging in the area will be higher when uncurtailed turbine blades are left to turn slowly in low wind speeds; it is a misperception that faster turning blades present a higher mortality risk.

3 METHODOLOGY

3.1 Literature-based and On-site Inspections

The site was evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water and drainage areas (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. These comparisons were done principally by briefly studying the geographic literature of each site, available satellite imagery and by ground-truthing with site visits. The probability of occurrence based on the above-mentioned factors was estimated for the species both expected and confirmed on site as well as the larger surrounding area.

3.2 Active & Passive Monitoring

In early February 2022, passive bat detection systems were set up on the Meteorological (Met) Mast on site, with microphones at 7m, 55m and 110m. Additionally, one Short Mast bat detection system was also set up, with a microphone at 7m (referred to as ShM1, see **Figure 3-1**). These systems were set to gather bat activity data every night for 12 months to form part of the long-term pre-construction monitoring and inform the Environmental Authorisation process. The locations of the Met Mast and Short Mast on site are indicated in **Figure 3-2** and a summary of the equipment setup is described in **Table 3-1**.

The data were analysed by classifying (as near to species level as possible) and counting positive bat passes detected by the systems. A bat pass is defined as a sequence of ≥1 echolocation calls where the duration of each pulse is ≥1ms (one echolocation call can consist of numerous pulses). A new bat pass is identified by a >1 000ms period between pulses. These bat passes were capped at one pass per minute to minimise pseudoreplication caused by a single bat calling repeatedly near a microphone within a short timeframe. The passes were then summed into hourly intervals which were used to calculate nocturnal distribution patterns over time. Times of sunset and sunrise were automatically adjusted with the time of year.

Figure 3-1: The passive bat detection system on Short Mast 1 (ShM1)

Table 3-1: Equipment setup and site visit information

Site visit dates		Setup	4 - 5 February 2022
		Interim visit 1	8 April 2022
		Season 1 site visit	19 June 2022
		Interim visit 2	22 July 2022
		Interim visit 3	19 August 2022
		Season 2 site visit	24 September 2022
		Interim visit 4	14 October 2022 (Met mast bat detector maintenance). 19 October 2022
		Interim visit 5	26 November 2022
		Season 3 site visit	16 December 2022
		Interim visit 6	19 January 2023
		Interim visit 7	17 February 2023
		Season 4 site visit	16 March 2023
Met mast passive bat detection systems	Quantity on site	1	
	Microphone heights	10m, 55m, 110m	
Short mast passive bat detection systems	Quantity on site	1	
	Microphone height	7m	
Type of passive bat detector		SM4BAT Full Spectrum	
Recording schedule		Each detector was set to operate in continuous trigger mode from dusk each evening until dawn (times were automatically adjusted in relation to latitude, longitude and season).	
Trigger threshold		>16KHz, -18dB	
Trigger window (time of recording after trigger ceased)		1 000ms (1 second)	
Microphone gain setting		12dB	

Compression	W4V-8
Single memory card size (each system uses 4 cards)	64GB
Battery	Custom-made internal lithium-ion batteries – replaced monthly on interim visits
Other methods	Terrain was investigated during the day for habitat observations.

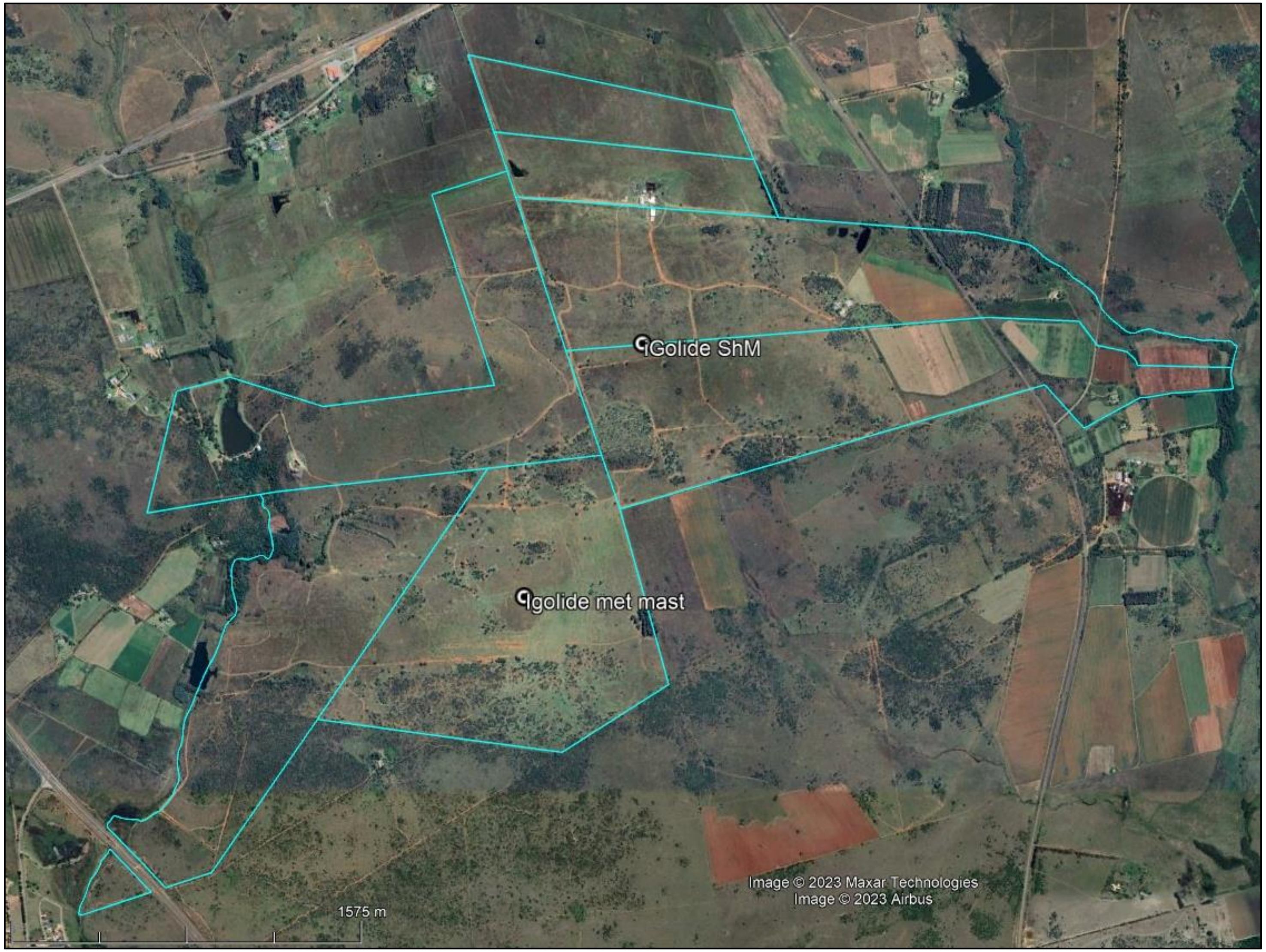


Figure 3-2: Passive bat detection systems set up on the Igolide Wind Farm

3.1 Sensitivity Mapping

Google Earth satellite imagery and verifications during site visits were used to spatially demarcate areas of the site with high and medium sensitivities relating to bat species ecology and habitat preferences. The map considers man-made structures and habitat alterations (such as dams), as well as natural terrain features that are likely to offer roosting and foraging opportunities for bat species found in the broader site area. With regards to hydrology features, distinction has been made between permanent and seasonal water sources. Clumps of trees (as opposed to scattered or single trees) offer significantly better roosting and foraging habitat on this site; they have received priority during sensitivity mapping.

3.2 Assumptions and Limitations

- Distribution maps of South African bat species still require further refinement, thus the bat species proposed to occur on the site (and not detected in the area yet) should be considered precautionary. If a species has a distribution marginal to the site, it was assumed to occur in the area.

- The migratory paths of bats are largely unknown, thus limiting the ability to determine if the wind farm will have a large-scale effect on migratory species. This limitation is partially overcome with the 12-months pre-construction sensitivity assessment, however some uncertainty in this regard will remain until the end of operational monitoring of at least 2 years.

- The sensitivity map is based partially on satellite imagery, and ground truthing from site visits. However, given the large extent of the site there is always the possibility that what has been mapped may differ slightly to what is on the ground.

- Species identification with the use of bat detection and echolocation is less accurate when compared to morphological identification, nevertheless it is a very certain and accurate indication of bat activity and their presence with no harmful effects on bats being surveyed.

- Automated species identification by the Kaleidoscope software may produce a small portion of incorrect identifications or unknown identifications. In the last-mentioned case, the dominant frequency of the unknown call was simply used to group the bat into a family or genus group, using dominant frequency only as the determining factor. However, the automated software is very effective at distinguishing bat calls from ultrasonic noise, therefore the number of bat passes are not significantly overestimated.

- It is not possible to determine actual individual bat numbers from acoustic bat activity data, whether gathered with transects or the passive monitoring systems. However, bat passes per night are internationally used and recognised as a comparative unit for indicating levels of bat activity in an area.

- Exact foraging distances from bat roosts or exact commuting pathways cannot be determined by the current methodology. Radio telemetry tracking of tagged bats is required to provide such information if needed.

- Periods of exceptional drought or rain during the pre-construction assessment study can influence bat numbers, causing measurements of lower or higher bat activity due to changes in typical water availability, and consequently, insect prey abundance.

4 RESULTS AND DISCUSSION

4.1 Land Use, Vegetation, Climate and Topography

The predominant land use of the wind farm site and surrounding properties is low-density livestock farming (grazing), and some cultivated land.

According to Mucina and Rutherford (2012), the proposed Igolide Wind Farm is situated entirely within the Grassland biome and straddles two vegetation units: Rand Highveld Grassland ad Gauteng Shale Mountain Bushveld (**Figure 4-1**).

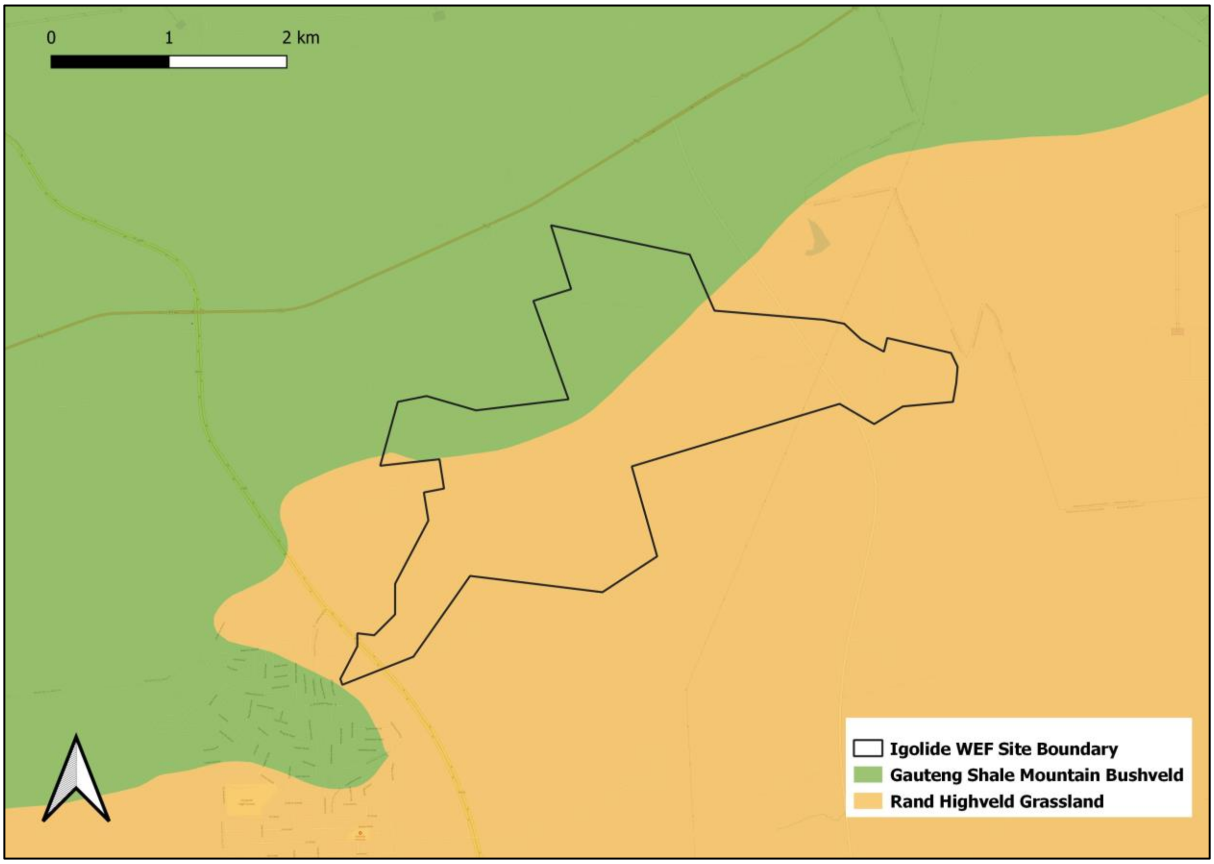


Figure 4-1: The Gauteng Shale Mountain Bushveld vegetation unit (green shading) and Rand Highveld Grassland (yellow shading) present on the proposed Igolide Wind Farm (Mucina and Rutherford 2012).

Vegetation units and geology are of great importance as these may serve as suitable sites for the roosting of bats and support of their foraging habits (Monadjem *et al.* 2010). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al.* 2010). The importance of the vegetation units and associated geomorphology serving as potential roosting and foraging sites have been described in **Table 4-1**: .

4.1.1 Rand Highveld Grassland

Rand Highveld Grassland is a variable and geographically disjunct landscape consisting of sloping plains and ridges. Grassland vegetation is species-rich, with low, shrubby stands on the outcrops of rocky slopes, and a high diversity of Asteraceae herbs. Savannoid woodlands exist sparsely on rocky hills or ridges. Quartzite ridges and soils of various quality are the dominant underlying geology of the unit.

Summer rainfall predominates and overall, warm-temperate conditions with very dry winters are experienced. Mean annual precipitation is approximately 650mm. Important species include grasses such as *Themeda triandra*, *Elionurus muticus*, *Diheteropogon amplectens* and *Tristachya leucothrix*. The vegetation unit is considered Endangered (Mucina and Rutherford 2006).

4.1.2 Gauteng Shale Mountain Bushveld

Gauteng Shale Mountain Bushveld is dominated by low, rocky ridges of varying steepness. Cover includes a semi-open thicket with woody species such as *Acacia caffra*, *Cussonia spicata*, *Euclea crispa* and *Dombeya rotundifolia*. Various grasses dominate the understorey.

Geologically, sedimentary rock in the form of shale and andesite underly the area, with shallow soils that are not prone to erosion. Climate is similar to that of Rand Highveld Grassland. The vegetation unit is classified as Vulnerable (Mucina and Rutherford 2006).

Table 4-1: Potential of the vegetation units to serve as suitable roosting and foraging spaces for bats.

Vegetation Unit	Foraging Potential	Roosting Potential	Comments
Gauteng Shale Mountain Bushveld	Medium - High	Medium	Grasslands, arable land and water sources can support sufficient insect numbers to be conducive for bat foraging. Roosting space is limited to man-made structures and some select groups of larger trees.
Rand Highveld Grassland	Medium - High	Medium	Grasslands, arable land and water sources can support sufficient insect numbers to be conducive for bat foraging. Roosting space is limited to man-made structures and some select groups of larger trees.

4.2 Protected areas, known sensitivities and caves/roosts within 100km from the site

The Tweefontein Private Nature Reserve is the closest protected area to the site, approximately 17.5km to the south east (**Figure 4-2**). This nature reserve is not a well-known hotspot for bat activity or bat roosts that may influence the site, although the presence of natural vegetation may promote bat diversity and activity levels.

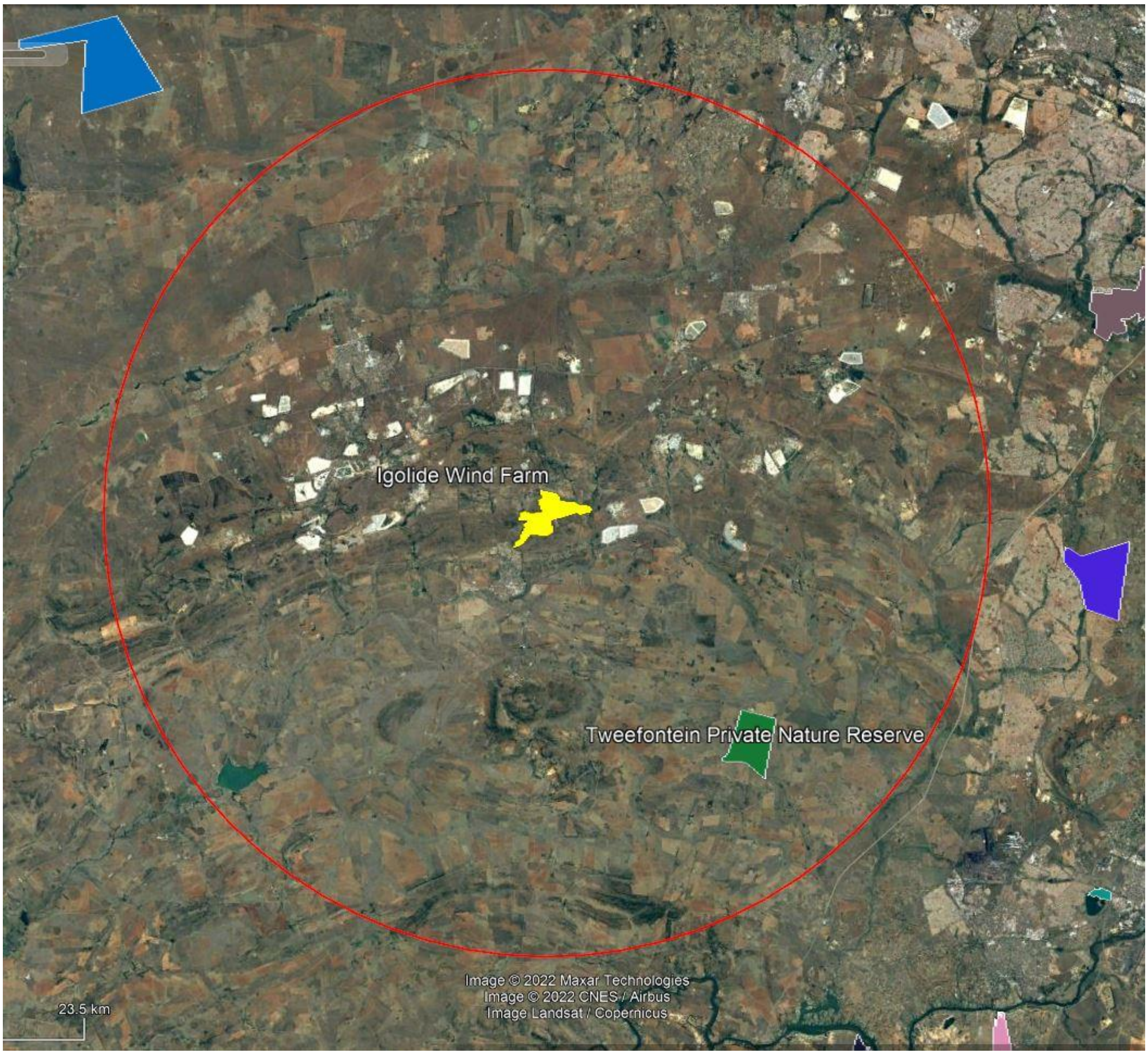


Figure 4-2: Protected areas within a radius of 30km (red line) around the site (SAPAD, DFFE, October 2021)

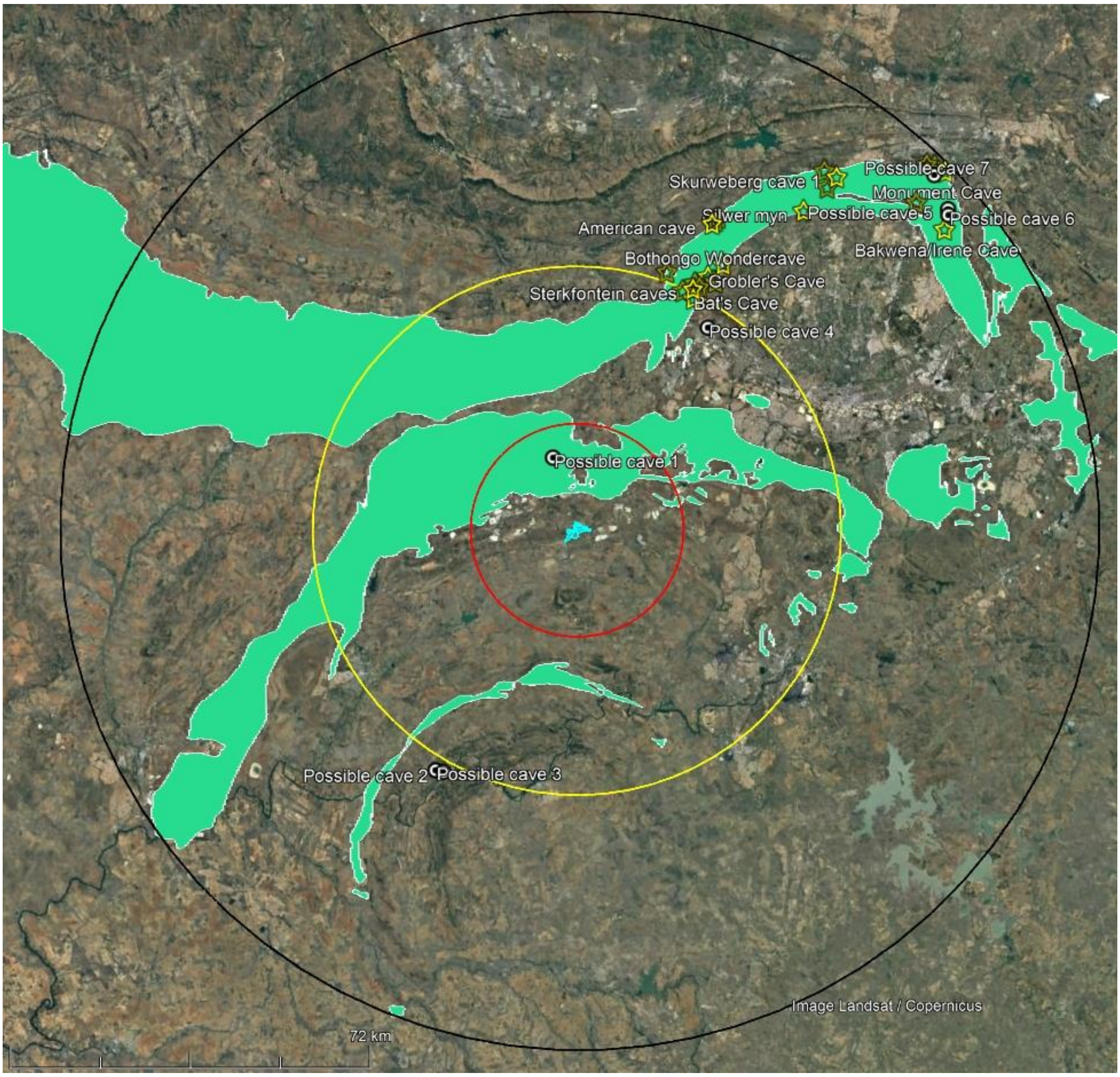


Figure 4-3: Confirmed and possible bat roosts within 100km (black circle), 50km (yellow circle) and 20km (red circle) of the site. Dolomite geology indicated in green.

The SEA assigns 20km high sensitivity and 50km medium sensitivity buffers to large bat roosts for wind energy. Based on museum records of cave bats in the area there may be a possible cave within 20km of the site (called Possible Cave 1). However the bat activity data collected over 12 months do not indicated abnormally high levels of cave bat activity that may indicate activity of this cave to be overlapping with the site.

Other caves, some with large bat roosts and most with the potential to house large roosts, within the 50km and 100km radius include: Nash’s Cave, Bat’s Cave, Bakwena/Irene Cave, Skurweberg Caves, Gladysvale Mine, American Cave, Monument Cave, Fountains Cave, Scramblers, Sterkfontein, Gladysvale Mine, Kromdraai Mine, Minaar’s Cave, Wondercave, Silwer Myn, Grobler’s Cave, Porcupine Cave, Mamelodi Cave, Groenkloof, Swartkop cave.

It must be noted that these caves are grouped to the North of the site and movement between these caves will not be affected by the WEF. Only movement between Possible Cave 1 , 2 and 3 may be affected by the WEF, although the passive data did not indicate migration movements. However, the prevalence of cave forming dolomite within 6km from the site increases the likelihood of undiscovered caves significantly, and the possibility of future bat migrations during the operational phase must be accounted for in reactive mitigation measures.

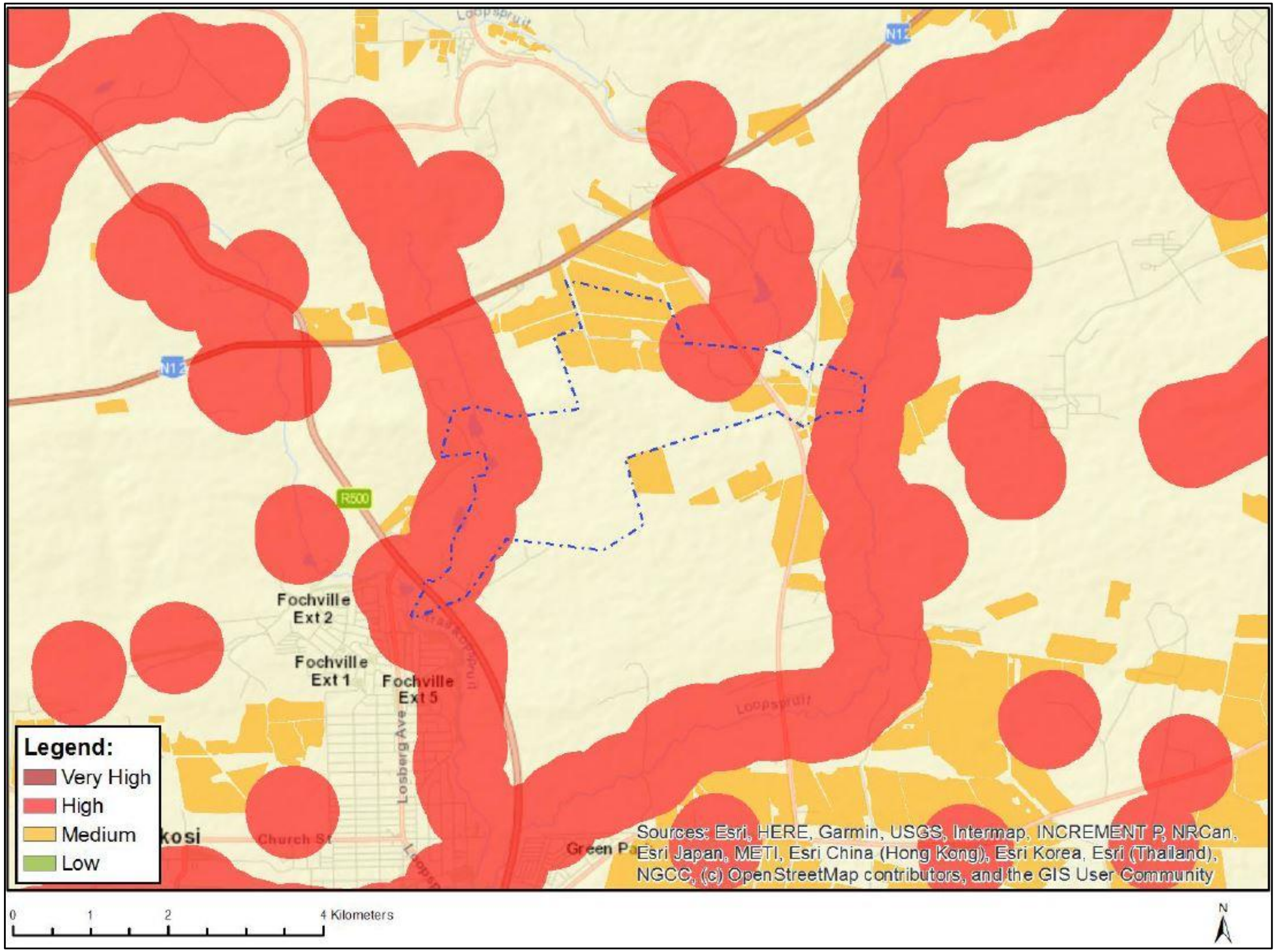


Figure 4-4: Possible bat sensitivity features and areas wind energy for Igolide Wind Farm according to the National Environmental Screening Tool, as downloaded from https://screening.environment.gov.za/screeningtool/index.html#/app/screen_tool/Wind

In **Figure 4-4,** the red areas indicate high bat sensitivity hydrology features which are wetlands or a 500m buffer around these wetlands and/or rivers. Orange areas are designated medium sensitivity due to the presence of croplands. The remaining areas are not assigned any sensitivity by the Screening Tool. The sensitivities of the National Screening Tool have been considered by the specialist, however the sensitivity map produced with this scoping study deviates somewhat from the Screening Tool which is considered a courser output. The deviations are based on detailed site visits and rigorous assessment of satellite features.

The Site Sensitivity Verification Methodology

The methodology of the Site Sensitivity Verification process involved for the site to be evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. These comparisons were done by briefly studying the geographic literature of each site, available satellite imagery and by ground truthing with site visits. Species probability of occurrence based on the above-mentioned factors were estimated for the site and the surrounding larger area, but also considers species historically confirmed on site as well as surrounding areas.

Outcome of the Site Sensitivity Verification:

The bat sensitivity map produced by the specialist, based on the methodology described above, is relatively similar to the Screening Tool sensitives with regards to the identification of several water courses and open water sources as high sensitivity areas.

Conclusion of the Site Sensitivity Verification:

The sensitivities identified in the specialist assessment have been verified by the above-mentioned methodology.

4.3 Ecology of bat species that may be impacted the most by the Wind Farm

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed wind farm, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at nearby wind farms. The relevant species are discussed below.

Tadarida aegyptiaca

The Egyptian Free-tailed Bat, *Tadarida aegyptiaca*, is a Least Concern species (IUCN Red List 2016) as it has a wide distribution and high abundance throughout South Africa and is part of the Free-tailed bat family (Molossidae). It occurs from the Western Cape of South Africa, north through to Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem *et al*. 2020). This species is protected by national legislation in South Africa (ACR 2018). They roost communally in small (dozens) to medium-sized (hundreds) groups in rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadarida aegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses (Monadjem *et al*. 2020). Thus, the rocky boulder crevices and man-made structures on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savannah, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem *et al*. 2020).

After a gestation of four months, a single pup is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

The Egyptian Free-tailed bat is considered to have a high likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020) and are displaying moderate to high numbers of mortalities at operating wind farms in South Africa. Due to the high abundance and widespread distribution of this species, high mortality rates due to wind turbines would be a cause of concern as these species have more significant ecological roles than the rarer bat species.

Laephotis capensis

Laephotis capensis (Cape serotine bat) has a conservation status of Least Concern (IUCN Red List 2016) as it is found in high numbers and is widespread over much of Sub-Saharan Africa. High mortality rates of this species due to wind turbines would be a cause of concern as *L. capensis* is abundant and widespread and as such has a more significant role to play within the local ecosystem than the rarer bat species. They do not undertake migrations and thus are considered residents of the site. It roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, and inside the roofs of houses. They will use most man-made structures as day roosts which can be found on the site and surrounding areas (Monadjem *et al*. 2020).

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occurs. They give birth to twins during late October and November, but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter mostly, but can occasionally forage in open spaces. They are thought to have a Medium-High likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020). And are displaying moderate to high numbers of mortalities at operating wind farms in South Africa.

Miniopterus natalensis

Miniopterus natalensis (Natal long-fingered bat), occurs widely across the country but mostly within the southern and eastern regions and is listed as Near Threatened (Monadjem *et al*. 2020). This bat is a cave-dependent species and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies in South Africa. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem *et al*. 2020)

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem et al. 2020 & Van Der Merwe 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they are considered to be at high risk of fatality from wind turbines if a wind farm is placed within a migratory path (MacEwan *et al*. 2020). The mass movement of bats during migratory periods could result in mass casualties if wind turbines are positioned over a mass migratory route and such turbines are not effectively mitigated. Very little is known about the migratory behaviour and paths of *M. natalensis* in South Africa with migration distances exceeding 150 kilometres. However, from personal observations it has been noted that they can occur individually or in small groups in rock hollows or man-made structures such as culverts.
MacEwan et al. (2020) advise that *M. natalensis* faces a medium to high risk of fatality due to wind turbines. This evaluation was based on broad ecological features and excluded migratory information. And are displaying low to moderate numbers of mortalities at operating wind farms in South Africa.

4.4 Passive Bat activity

Passive bat data was collected for the 12-month monitoring at the Igolide Wind Farm between the period of October 2021 to March 2023 for the Short Mast and February 2022 to March 2023 for the Met Mast. **Figures 4-5 to 4-10** graphically display the data collected, pertaining to the total bat passes recorded at the Met Mast (7m, 55m and 110m) and the Short Mast systems (7m), as well as the average hourly bat passes per system.

Bat activity was divided into categories (**Table 4-23**) according to the risk of being impacted on by wind turbines, as well as other important ecological significance (as is the case with cave bats).

Table 4-2. The categories used for grouping and presenting bat activity in the passive bat activity graphs. "Risk" represents the likelihood of fatality to turbine collision.

Graph category and abbreviation	Motivation of graph category	Species detected in graph category
High risk (H)	• **Open-air foragers** • **High-flying in rotor swept zone**	• ***Tadarida aegyptiaca*** • **Other members of Molossidae family**
Medium – High risk (MH)	• **Migrant bats, can influence multiple ecologies** • **Cave bats, may possibly indicate presence of undiscovered bat cave roosts or migartions** • **Can also roost in non-cave hollows** • **Forages on the edges of vegetation clutter (clutter-edge foragers)** • **Medium height foraging, overlapping with lower rotor swept zone**	• ***Miniopterus natalensis*** • ***Miniopterus* spp.** • ***Myotis tricolor***
Medium risk (M)	• **Forages on the edges of vegetation clutter (clutter-edge foragers)** • **Medium height foraging, overlapping with lower rotor swept zone**	• ***Laephotis capensis*** • ***Eptesicus hottentotus*** • **Other members of Vespertilionidae family**
Low risk (L)	• **Non-migrant cave and hollow dwelling bats, but may possibly indicate presence of caves, therefore presented in graphs**	• ***Rhinolophus* spp.**

Graph category and abbreviation	Motivation of graph category	Species detected in graph category
	• **Forages in dense vegetation clutter (clutter foragers)** • **Low height foraging, outside rotor swept zone**	

The five bat species detected on site were: *Eptesicus hottentotus, Tadarida aegyptiaca, Myotis tricolor, Laephotis capensis,* and *Miniopterus natalensis*. Additionally, bat passes were recorded that are classified up to family level for the Vespertilionidae and Rhinolophidae. First mentioned is taxonomically a large family that includes many species that behave ecologically similarly with regards to their risk of collision with wind turbines. When the frequency of their vocalisations overlaps, these species are more difficult to distinguish from one another, and are grouped together.

It must be noted that the species *Laephotis capensis* (Cape Serotine bat) is very well-represented in the data for this site. *L. capensis* (part of Medium risk category) displayed an abnormally high peak of activity during the autumn of 2022 at 110m on the Met Mast, this is unusual since this species is not generally utilising the higher airspaces frequently. A smaller peak was observed during late winter and early spring is 2022. These activity peaks may be due to the mating season of this species being in autumn and birth of young being in late winter and spring (generally October).

However, bat activity was still overall higher on low microphones than higher microphones, as expected. Since the Medium risk category dominated at all systems and at all heights, with *L. capensis* displaying the highest activity levels at both masts. And *L. capensis,* that forages on the edge of vegetation clutter, made up the majority of the Medium risk category.

The temporal data displays the spread of bat activity over each month and may indicate abrupt peaks in activity. *Miniopterus natalensis* is a cave dwelling species within the High-Medium risk category, but may also take residence in smaller numbers in culverts and other suitable man-made hollows, this species did not show any abrupt peaks of activity that may indicate that the site is on any migration route. The species was not particularly frequently recorded on the systems, although it was present in the data from each system.

Average hourly activity is useful since it considers only the nights on which the systems recorded successfully, and are therefore a true indication of monthly activity levels. The seasons of autumn and spring had the highest average activity levels across all systems on site. These higher activity months are important to consider in case mitigation may be required during the operational phase.

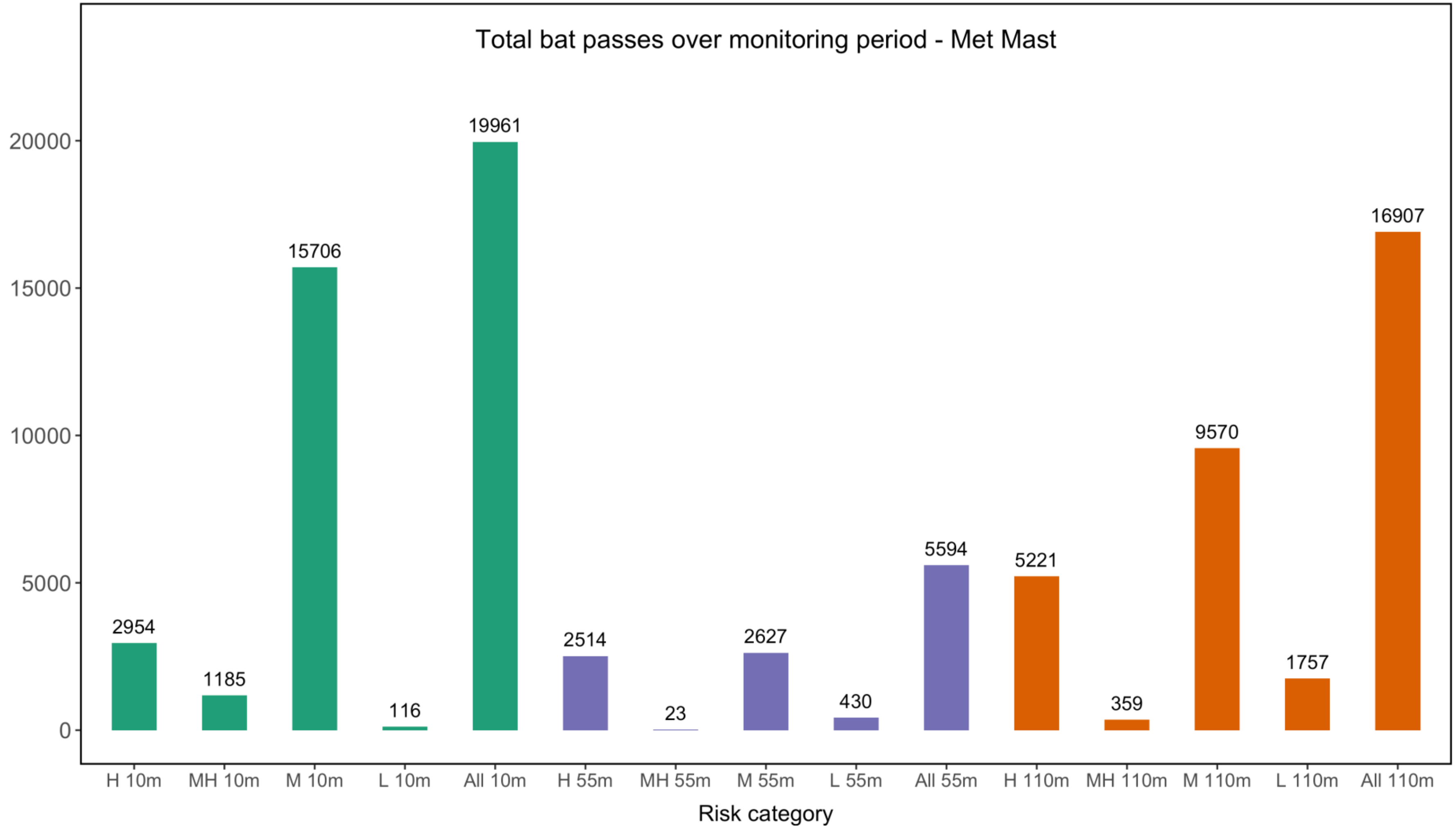


Figure 4-5: Total number of bat passes recorded over the monitoring period by the Met Mast.

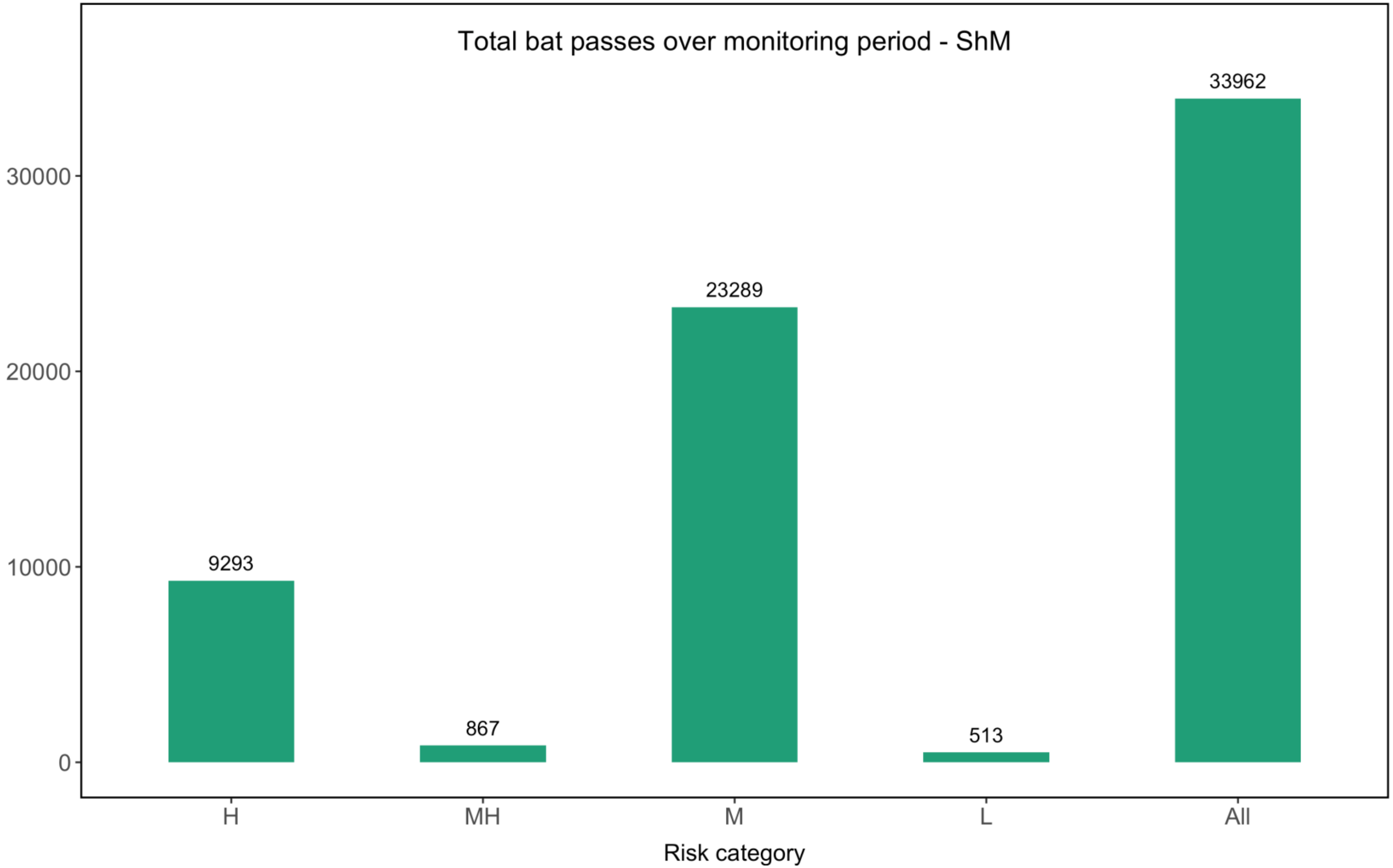


Figure 4-6: Total number of bat passes recorded over the monitoring period by Short Mast1 (ShM1)

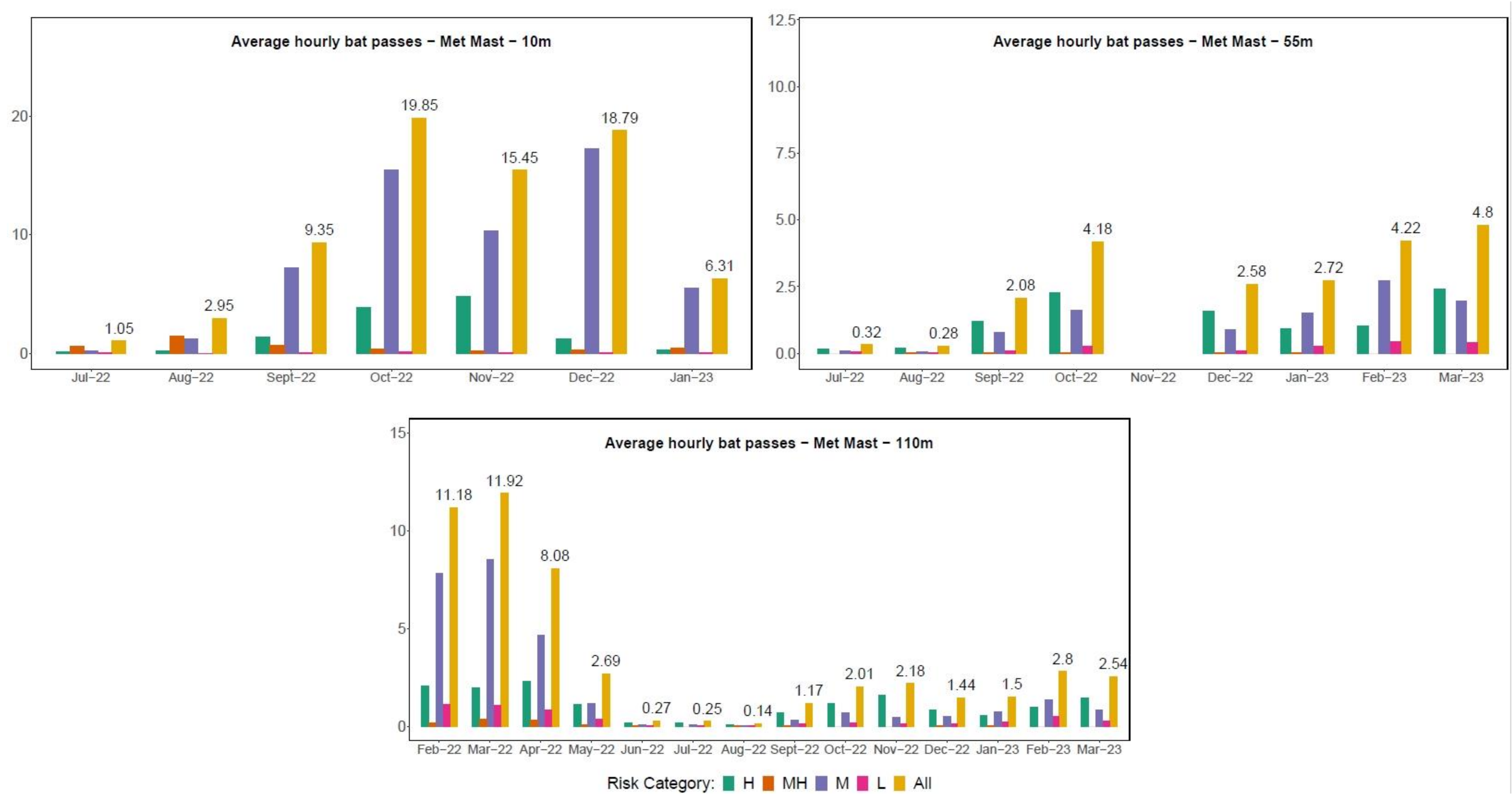


Figure 4-7: Average hourly bat passes recorded per month by the Met Mast – 10m, 55m and 110m

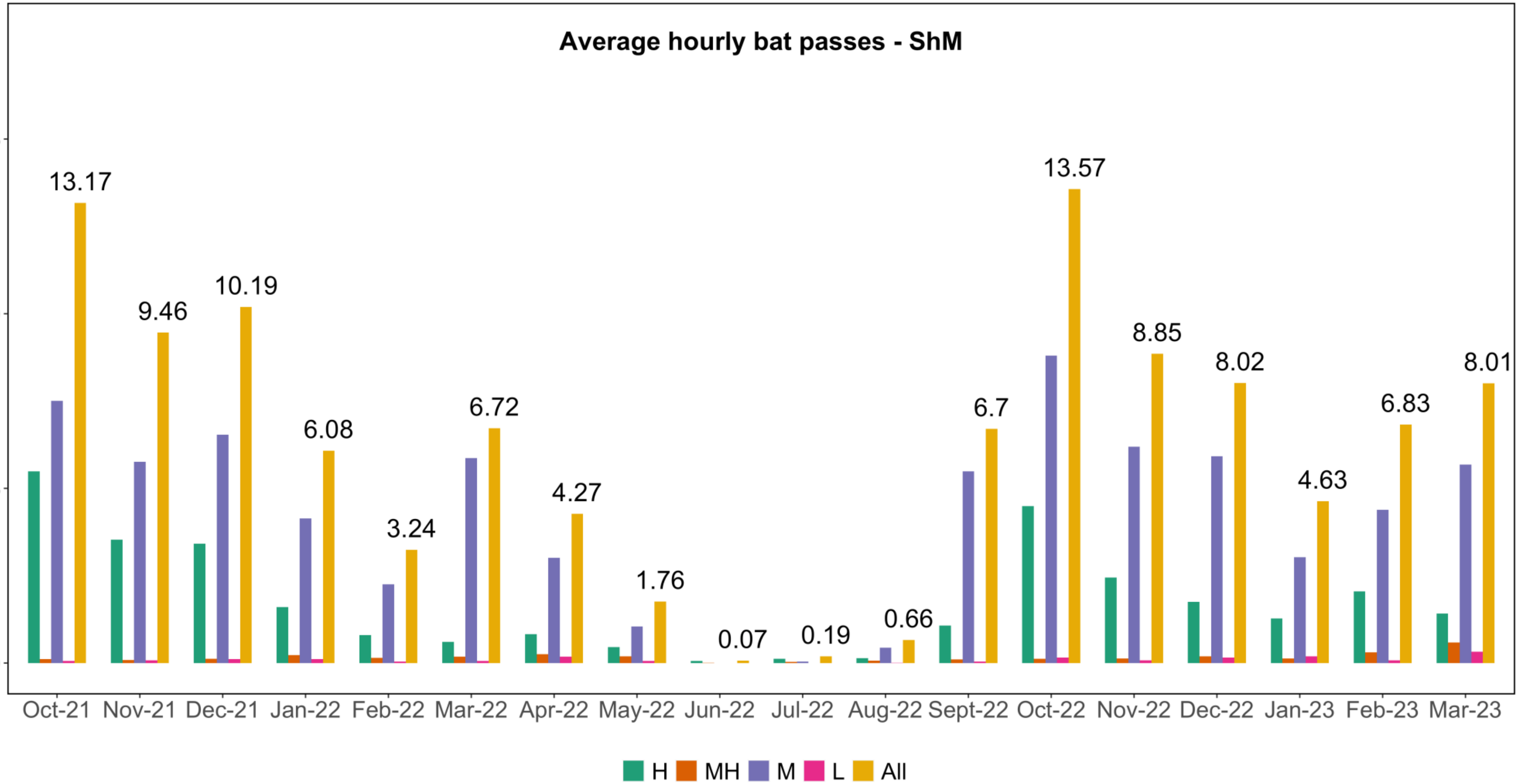


Figure 4-8: Average hourly bat passes recorded per month by Short Mast1.

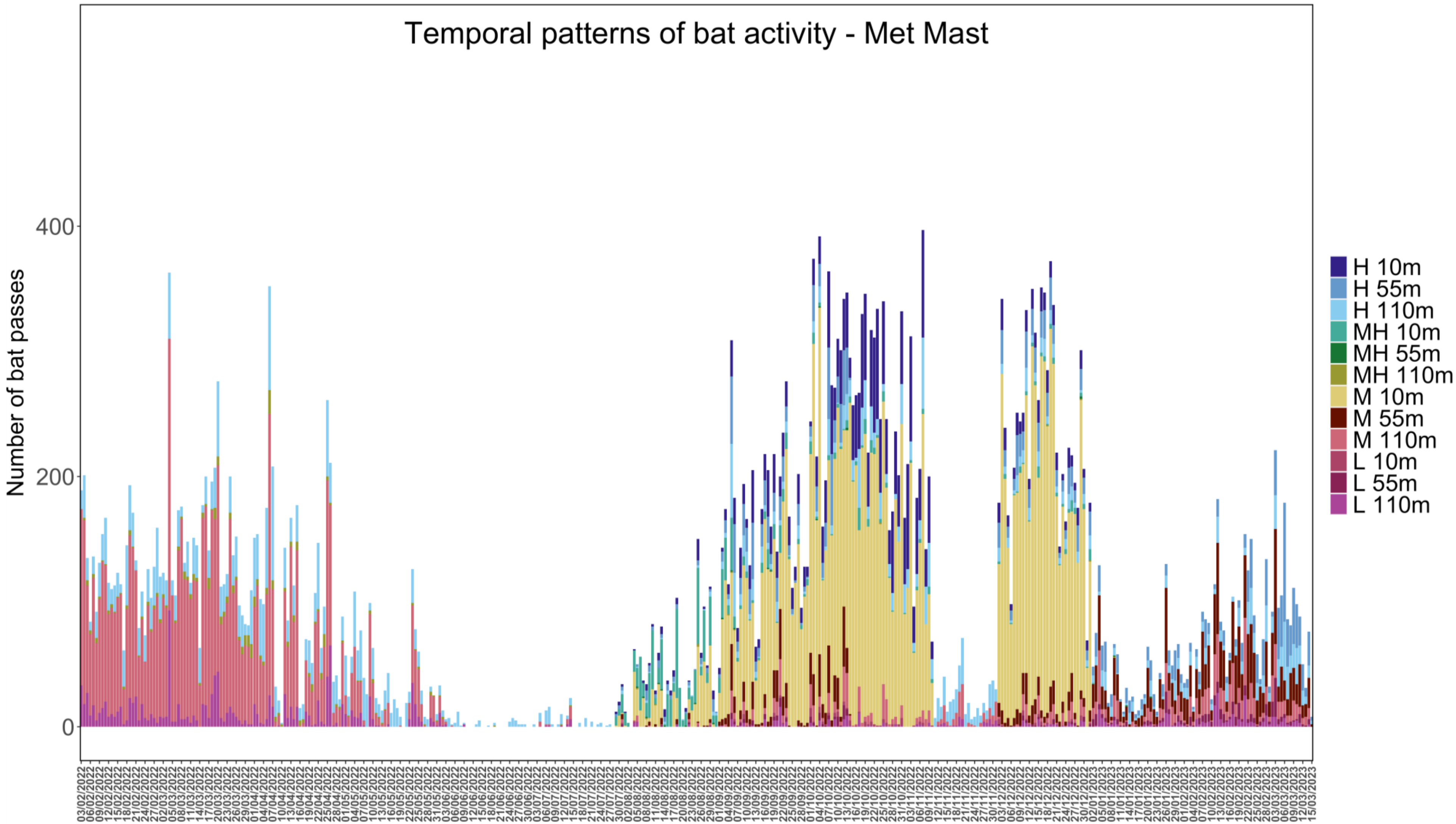


Figure 4-9: Temporal distribution of bat passes detected over the monitoring period by the Met Mast.

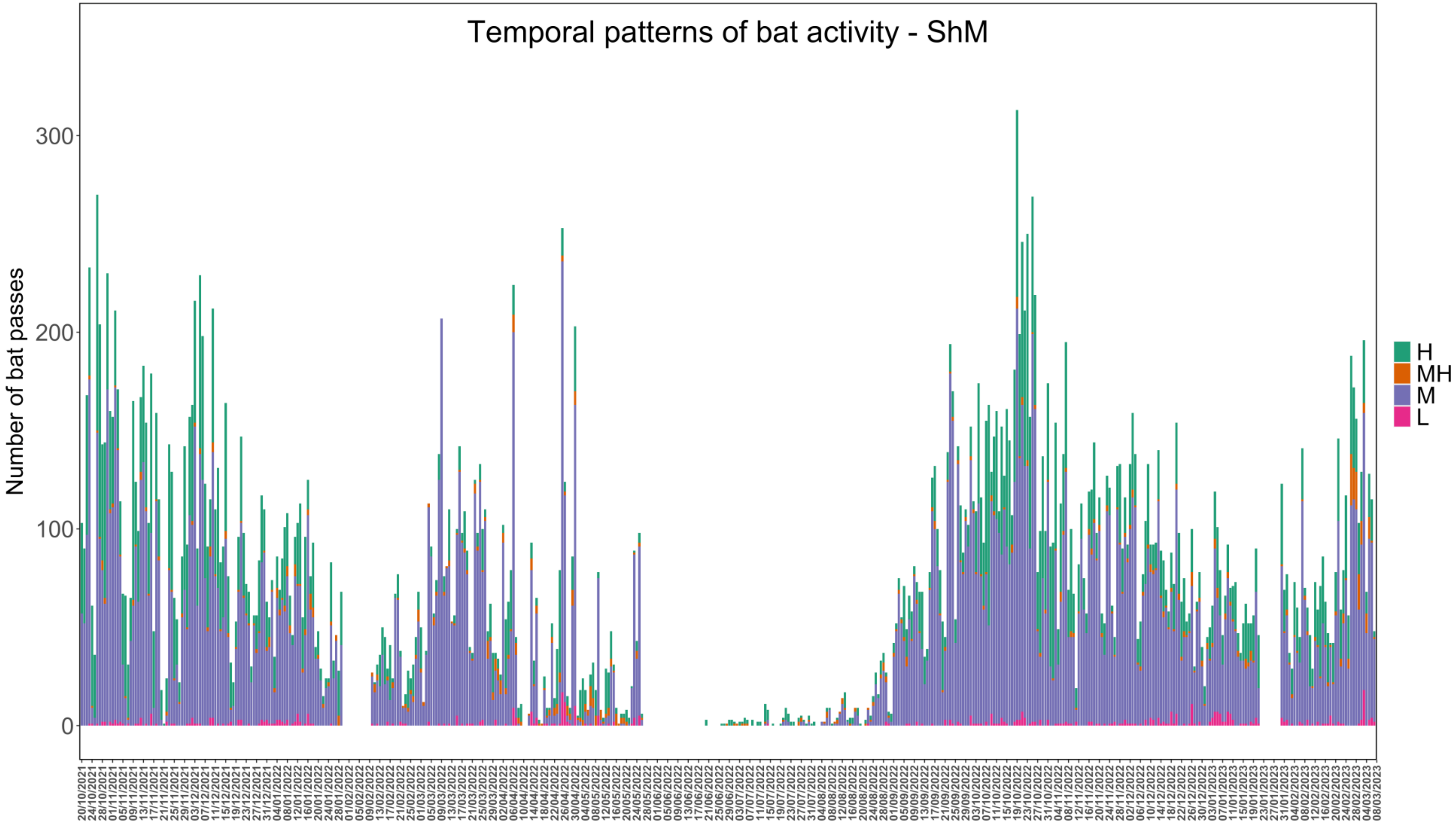


Figure 4-10: Temporal distribution of bat passes detected over the monitoring period by Short Mast 1.

4.5 Sensitivity Map

Figure 4-11Error! Reference source not found. depicts the sensitive areas of the site, based on features identified to be important for foraging and roosting of the species that most commonly occur on site. Thus, the sensitivity map is based on species ecology and habitat preferences.

Considering the current layout, and a blade length of 100m, the blade overhangs of Turbines 1, 2, 5, 8, 9, 11 and 12 are intruding into high bat sensitivity buffers (Table 4-5). These turbines must be relocated to have their blade overhang outside of the bat high sensitivity buffers prior to the layout receiving Environmental Authorisation.

Table 4-3: Description of parameters used in the construction of the sensitivity map.

Last revision	**June 2023**
High sensitivities and 200m buffers	Valley bottom wetlands.
	Pans and depressions.
	Dams.
	Clumps of larger trees especially when close to farm buildings and water sources
	Farm building and structures especially when close to irrigated land, water sources and clumps of trees.
	Drainage lines capable of supporting riparian vegetation.
	Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds.
Moderate sensitivities and 150m buffers	Looser smaller groups of trees
	Seasonal drainage lines.

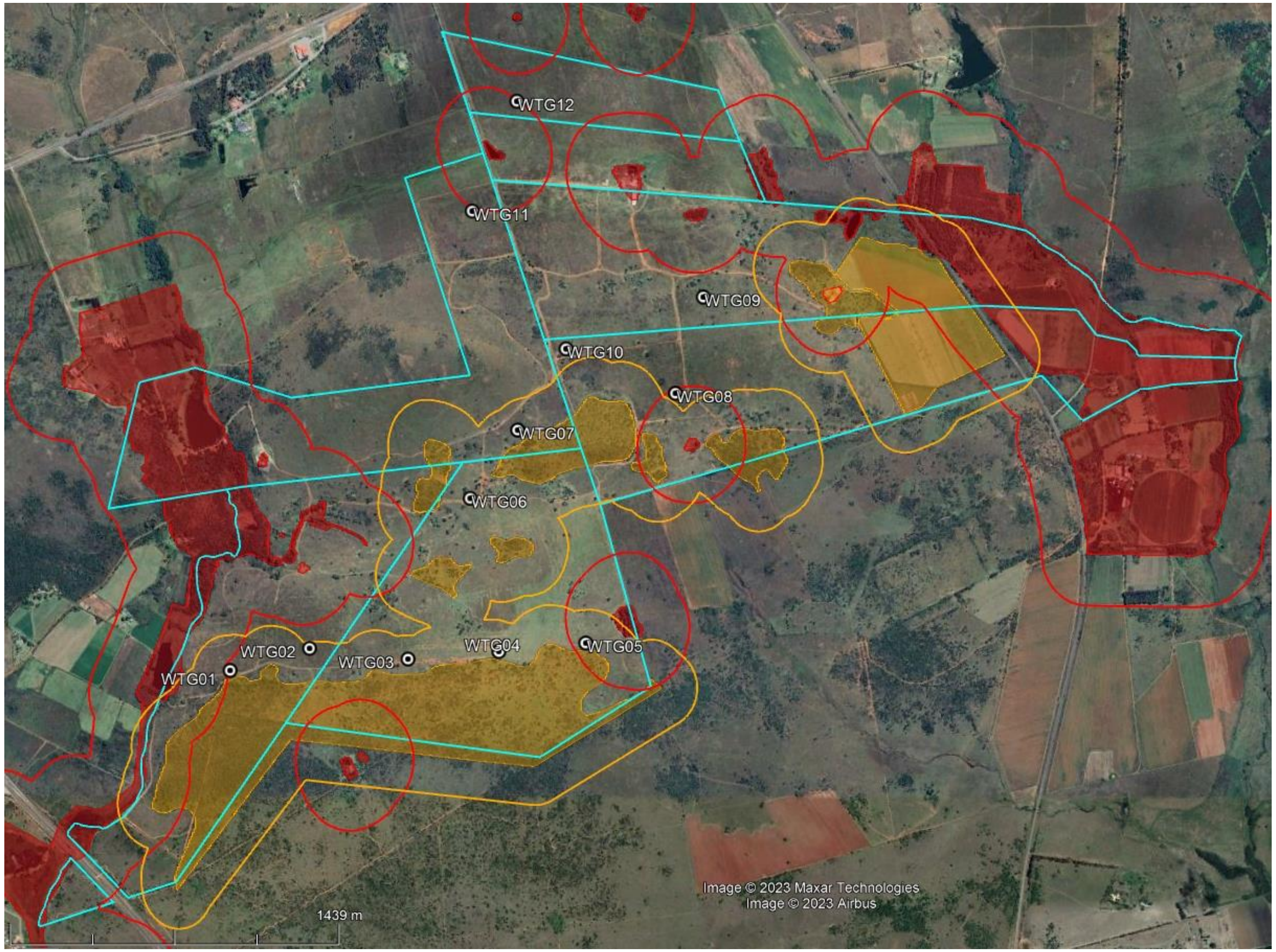
Table 4-4: Igolide Wind Farm turbines located within bat sensitive areas and buffers.

Bat sensitive area	Turbines within sensitivity feature (based on a 100m blade length)
High bat sensitivity area (no-go areas)	None
High bat sensitivity buffer (no-go areas)	WTG 1, 2, 5, 8, 9, 11, 12
Moderate bat sensitivity area	WTG 1, 3, 4, 5, 7
Moderate bat sensitivity buffer	WTG 2, 6, 8, 10

Table 4-5: The significance of sensitivity map categories for each infrastructure component.

Sensitivity	Turbines	Roads and cables	Internal overhead transmission lines	Buildings (including substation, battery storage facility and construction camp/yards)
High Sensitivity	These areas are 'no-go' zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Preferably keep to a minimum within these areas where practically feasible.	Allowed inside these areas.	Avoid these areas (no-go areas).
High Sensitivity buffer	These areas are 'no-go' zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Allowed inside these areas.	Allowed inside these areas.	Preferably keep to a minimum within these areas where practically feasible.
Moderate Sensitivity	Turbines within these areas may require priority (not excluding all other turbines) during post-construction studies, and in some instances, there is a higher likelihood that mitigation measures may need to be applied to them.	Allowed inside these areas.	Allowed inside these areas.	Allowed inside these areas.

Sensitivity	Turbines	Roads and cables	Internal overhead transmission lines	Buildings (including substation, battery storage facility and construction camp/yards)
Moderate Sensitivity buffer	Turbines within these areas may require priority (not excluding all other turbines) during post-construction studies, and in some instances, there is a higher likelihood that mitigation measures may need to be applied to them.	Allowed inside these areas.	Allowed inside these areas.	Allowed inside these areas.



High bat sensitivity area — High bat sensitivity buffer 200m

Moderate bat sensitivity area — Moderate bat sensitivity buffer 150m

Figure 4-11: Bat sensitivity map of the proposed Igolide Wind Farm site, showing moderate and high sensitivity zones and their buffers.

5 IMPACT IDENTIFICATION

Tables 5-1 to 5-3 below indicate the identified impacts associated with the proposed Igolide Wind Energy Facility during the construction and operational phases. No significant impacts are identified for the decommissioning phase.

5.1 Construction phase

Table 5.1. Identified potential impacts of the proposed Igolide WEF facility as well as possible mitigation measures, during construction.

Potential impact	Impact significance (without mitigation)	Possible mitigation
Loss of foraging habitat by clearing of vegetation.	Probability (4) and Consequence (1) = Significance Medium	Adhere to the sensitivity map criteria. Rehabilitate cleared vegetation where possible at areas such as laydown yards.
Roost destruction during earthworks.	Probability (2) and Consequence (3) = Significance Medium	Adhere to the sensitivity map criteria, choose location alternatives that don’t intrude into high bat sensitivities.

5.2 Operational phase

Table 5.2. Identified potential impacts of the proposed Igolide WEF facility as well as possible mitigation measures, during operation.

Potential impact	Impact significance (without mitigation)	Possible mitigation
Bat mortalities by blade impact or barotrauma (resident bats)	Probability (4) and Consequence (3) = Significance High	Avoid no-go areas by adhering to the sensitivity map. The blade overhangs of Turbines 1, 2, 5, 8, 9, 11 and 12 are intruding into high bat sensitivity buffers. These turbines must be relocated to have their blade overhang outside of the bat high sensitivity buffers prior to the Final Site Layout Plan being approved. Where needed, and if indicated during EIA phase, reduce blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to Section 6.
Bat mortalities by blade impact or barotrauma (migrating bats)	Probability (3) and Consequence (4) = Significance High	Avoid no-go areas by adhering to the sensitivity map. The blade overhangs of Turbines 1, 2, 5, 8, 9, 11 and 12 are intruding into high bat sensitivity buffers. These turbines must be relocated to have their blade overhang outside of the bat high sensitivity buffers prior to the Final Site Layout Plan being approved. Where needed, and if

		indicated during EIA phase, reduce blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to Section 6. If the WEF is in a migration path, appropriate measures should be be applied to ensure that the WEF bat mortalities are below a sustainable threshold.
Increased bat mortalities due to light attraction and habitat creation.	Probability (4) and Consequence (3) = Significance High	Only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. This will be at all infrastructure buildings. For buildings, avoid tin roofs and roof structures that offer entrance holes into the roof cavity. The storm water drainage plan must avoid creations of artificial ponds/open water sources or wetlands near turbines (closer than 300m from any turbine base), of the proposed Igolide WEF. As such artificial water sources will increase insect activity and therefore bat activity in the area.

5.3 Cumulative impact

Table 5.3. Identified cumulative potential impacts of the proposed Igolide WEF facility.

Potential impact	**Impact significance (without mitigation)**	**Possible mitigation**
Construction phase		
Loss of foraging habitat by clearing of vegetation.	Probability (4) and Consequence (1) = Significance Medium	Each facility to adhere to its respective sensitivity map criteria. Rehabilitate cleared vegetation where possible at areas such as laydown yards.
Roost destruction during earthworks.	Probability (2) and Consequence (2) = Significance Low	Each facility to adhere to its respective sensitivity map criteria. Choose location alternatives for the Igolide WEF facility that don't intrude into high bat sensitivities.
Operational phase		
Bat mortalities by blade impact or barotrauma (resident bats)	Probability (4) and Consequence (3) = Significance High	Each facility to avoid no-go areas by adhering to their respective sensitivity map. Where needed, and if indicated during EIA phase, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to Section 6.

Bat mortalities by blade impact or barotrauma (migrating bats)	Probability (3) and Consequence (4) = Significance High	Each facility to avoid no-go areas by adhering to their respective sensitivity map. Where needed, and if indicated during EIA phase, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to Section 6. Each WEF in a migration path should apply appropriate mitigation measures to ensure that each facility's bat mortalities are below a sustainable threshold.
Increased bat mortalities due to light attraction and habitat creation.	Probability (4) and Consequence (3) = Significance High	Each facility to only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. This will be at all infrastructure buildings. For buildings, avoid tin roofs and roof structures that offer entrance holes into the roof cavity. The storm water drainage plan must avoid creations of artificial ponds/open water sources or wetlands near turbines (closer than 300m from any turbine base), of the proposed Igolide WEF turbines.

		As such artificial water sources will increase insect activity and therefore bat activity in the area.

6 POSSIBLE MITIGATION MEASURES

The EIA study will include a step-by-step Mitigation Action Plan that must be included into the EMPr in its entirety, and must also be referred to in the conditions of Environmental Authorisation (EA) and be implemented immediately once the WEF becomes operational. Note that some mitigations to minimise light pollution or requirements like the appointment of a specialist for a bat mortality study, must be initiated before the commercial operational date of the WEF.

The bat specialist conducting the operational bat monitoring may overwrite applicable sections of this mitigation plan, but only when robust and more applicable bat activity and climate data are available for specific problematic turbines or areas of the site.

The available options to minimise bat mortalities are discussed in this section. Details on if, when or how each option must be implemented will be explained in the step-by-step Mitigation Action Plan in the EIA study.

6.1 Minimisation of light pollution and artificial habitat creation

A mitigation to consider in the design of the WEF is to keep artificial lighting to a minimum on the infrastructure (O&M buildings and on wind turbines), while still adhering to safety and security requirements. For example, this can be achieved by having floodlights down-hooded, installing passive motion sensors onto lights around buildings and possibly utilising lights with lighting colours (also referred to as lighting temperatures) that attract fewer insects. Light pollution will impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights.

Stormwater management should also avoid creating artificial wetlands and open water sources in the turbine zones (closer than 300m from any turbine base), as this will increase insect and bat activity around turbines.

The likelihood of bats being killed by moving turbine blades increases significantly when they are attracted to their proximity, when it has become an improved foraging airspace due to the presence of artificial light or artificial water sources.

6.2 Curtailment to prevent freewheeling

Freewheeling occurs when the turbine blades are rotating in wind speeds below the generator cut-in speed (also called the manufacturer's cut-in speed), thus no electricity is being produced and only some blade momentum is maintained.

Since bat activity tends to be negatively correlated with wind speed, it means that high numbers of bats are likely to be flying and impacted on in low wind speeds where freewheeling may occur. If turbine blades are feathered below the generator cut-in speed to prevent freewheeling, it can result in a very significant reduction of bat mortalities with minimal energy production loss.

6.3 Curtailment that increases the cut-in speed

The activity levels of South African bats generally decrease in weather conditions with increased wind speeds. However, in scenarios where above sustainable numbers of bats are being killed, and these bats fly in wind speeds above the turbine manufacturer's cut-in speed, the turbine's computer control system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) can be programmed to a cut-in speed higher than the manufacturer's set speed. The new cut-in speed will then be referred to as the mitigation cut-in speed and can be determined from studying the relationship between long term (12-month) bat activity patterns on site and wind speed. This sustainable threshold of bat mortalities will be calculated according to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018).

Turbines may be curtailed in this manner by means of blade feathering, to render the blades near motionless in wind speeds below the mitigation cut-in speed.

6.4 Acoustic bat deterrents

This technology is developed well enough to be tested on site and may be recommended during operational monitoring, if mortality data indicate bat mortalities above the sustainable threshold for the WEF. This threshold will be calculated according to the *South African Bat*

Fatality Threshold Guidelines (MacEwan, *et al.*, Edition 2, October 2018). Initial experiments with this technology on WEFs in South Africa are yielding positive results that may indicate the effectiveness of the devices, but in the correct scenarios for certain species.

Current data on the South African trials is still limited to a small sample set, and the technology will not necessarily be effective in all mitigation scenarios and for all bat species. Therefore, it should be considered and tested on a case-by-case basis if possible, and it is highly recommended that adequate monitoring continues concurrently, to assess the effectiveness of the devices in reducing bat mortalities.

7 CONCLUSION

This scoping report considers information from October 2021 to March 2023. Passive bat detection systems (**Figure 3-**) have been set up on the meteorological mast with microphones at 7m, 55m and 110m. Additionally, a short mast bat detection system has also been set up, with a microphone at 7m (referred to ShM1). These systems were set to gather bat activity data every night for 12 months to form part of the long-term pre-construction monitoring and inform the Environmental Authorisation process.

Information from bat activity data from site, confirms that the five bat species detected on site were: *Eptesicus hottentotus, Tadarida aegyptiaca, Myotis tricolor, Laephotis capensis,* and *Miniopterus natalensis*. Additionally, bat passes were recorded that are classified up to family level for the Vespertilionidae and Rhinolophidae.

It must be noted that the species *Laephotis capensis* (Cape Serotine bat) is very well-represented in the data for this site. *L. capensis* (part of Medium risk category) displayed an abnormally high peak of activity during the autumn of 2022 at 110m on the Met Mast, this is unusual since this species is not generally utilising the higher airspaces frequently. A smaller peak was observed during late winter and early spring is 2022. These activity peaks may be due to the mating season of this species being in autumn and birth of young being in late winter and spring (generally October).

However, bat activity was still overall higher on low microphones than higher microphones, as expected. Since the Medium risk category dominated at all systems and at all heights, with *L. capensis* displaying the highest activity levels at both masts. And *L. capensis,* that forages on the edge of vegetation clutter, made up the majority of the Medium risk category.

Miniopterus natalensis is a cave dwelling species within the High-Medium risk category, but may also take residence in smaller numbers in culverts and other suitable man-made hollows, this species did not show any abrupt peaks of activity that may indicate that the site is on any migration route. The species was not particularly frequently recorded on the systems, although it was present in the data from each system.

Average hourly activity is useful since it considers only the nights on which the systems recorded successfully, and are therefore a true indication of monthly activity levels. The seasons of autumn and spring had the highest average activity levels across all systems on site. These higher activity months are important to consider in case mitigation may be required during the operational phase.

The SEA assigns 20km high sensitivity and 50km medium sensitivity buffers to large bat roosts for wind energy. Based on museum records of cave bats in the area there may be a possible cave within 20km of the site (called Possible Cave 1). However the bat activity data collected over 12 months do not indicated abnormally high levels of cave bat activity that may indicate activity of this cave to be overlapping with the site.

Other caves, some with large bat roosts and most with the potential to house large roosts, within the 50km and 100km radius include: Nash's Cave, Bat's Cave, Bakwena/Irene Cave, Skurweberg Caves, Gladysvale Mine, American Cave, Monument Cave, Fountains Cave, Scramblers, Sterkfontein, Gladysvale Mine, Kromdraai Mine, Minaar's Cave, Wondercave, Silwer Myn, Grobler's Cave, Porcupine Cave, Mamelodi Cave, Groenkloof, Swartkop cave.

It must be noted that these caves are grouped to the North of the site and movement between these caves will not be affected by the WEF. Only movement between Possible Cave 1, 2 and 3 may be affected by the WEF, although the passive data did not indicate migration movements. However, the prevalence of cave forming dolomite within 6km from the site increases the likelihood of undiscovered caves significantly, and the possibility of future bat migrations during the operational phase must be accounted for in reactive mitigation measures.

A bat sensitivity map has been compiled to include probable roosting and important foraging habitats. **Considering the current layout, and a blade length of 100m, the blade overhangs of Turbines 1, 2, 5, 8, 9, 11 and 12 are intruding into high bat sensitivity buffers (Table 4-5). These turbines must be relocated to have their blade overhang outside of the bat high sensitivity buffers prior to the layout receiving Environmental Authorisation.** Mitigation through avoidance must be considered as the first layer of mitigation and must be applied as far as possible given the current knowledge of the site.

According to available information consulted during this study and up to date, there are no fatal flaws from a bat sensitivity perspective. Animalia has no objection to the project proceeding to the Environmental Impact Assessment phase.

8 REFERENCES

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