Bat Impact Assessment Scoping Report

- For the proposed Moriri Photovoltaic (PV) Energy Facility, Northern Cape, South Africa

Compiled by: Werner Marais & Diane Smith

29 October 2021

PREPARED FOR:

Great Karoo Renewable Energy (Pty) Ltd

By

ANiMALiA consultants

2015/364493/07
Somerset West
Cape Town
7130

www.animalia-consult.co.za

Ref: R-2110-18

Appointment of Specialist

Specialist Company:	Animalia Consultants (Pty) Ltd
Fieldwork conducted by:	Werner Marais
Report done by:	Werner Marais & Diane Smith
Appointed by:	Great Karoo Renewable Energy (Pty) Ltd
For:	Bat Impact Assessment Scoping Report

Independence

Animalia Consultants (Pty) Ltd has no connection with the developer. Animalia Consultants (Pty) Ltd is not a subsidiary, legally or financially of the developer; remuneration for services by the developer in relation to this Bat Impact Assessment Scoping Report is not linked to approval by decision-making authorities responsible for permitting this proposal and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project.

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 additional attention to those listed as Threatened or Protected.

Contents

1 OBJECTIVES AND TERMS OF REFERENCE FOR THE STUDY

- 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 identification of possible impacts on bats and a description of the nature and extent of each identified impact
- Identifying gaps in knowledge with regards to each identified impact on bats
- Presentation of no-go areas in the form of bat sensitivity mapping
- 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 Environmental Impact Assessment (EIA).

2 INTRODUCTION

This document is the Bat Scoping Report for the Moriri Photovoltaic (PV) Facility completed by Animalia Consultants (Pty) Ltd.

Great Karoo Renewable Energy (Pty) Ltd is proposing the construction and operation of a photovoltaic (PV) solar energy facility and associated infrastructure on Portion 0 of Farm Rondavel 85, located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~577ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Moriri Solar PV Facility with a contracted capacity of up to 100MW.

The Moriri Solar PV Facility project site is proposed to accommodate the following infrastructure, which will enable the facility to supply a contracted capacity of up to 100MW:The Moriri Solar PV Facility project site is proposed to accommodate the following infrastructure, which will enable the facility to supply a contracted capacity of up to 100MW:

- Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.
- Cabling between the panels.
- 33/132kV onsite facility substation.
- Cabling from the onsite substation to the collector substation (either underground or overhead).
- Electrical and auxiliary equipment required at the collector substation that serves that solar energy facility, including switchyard/bay, control building, fences, etc.

- Battery Energy Storage System (BESS).
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Laydown areas.
- Access roads and internal distribution roads.

The solar PV facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Moriri Solar PV Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Moriri Solar PV Facility set to inject up to 100MW into the national grid.

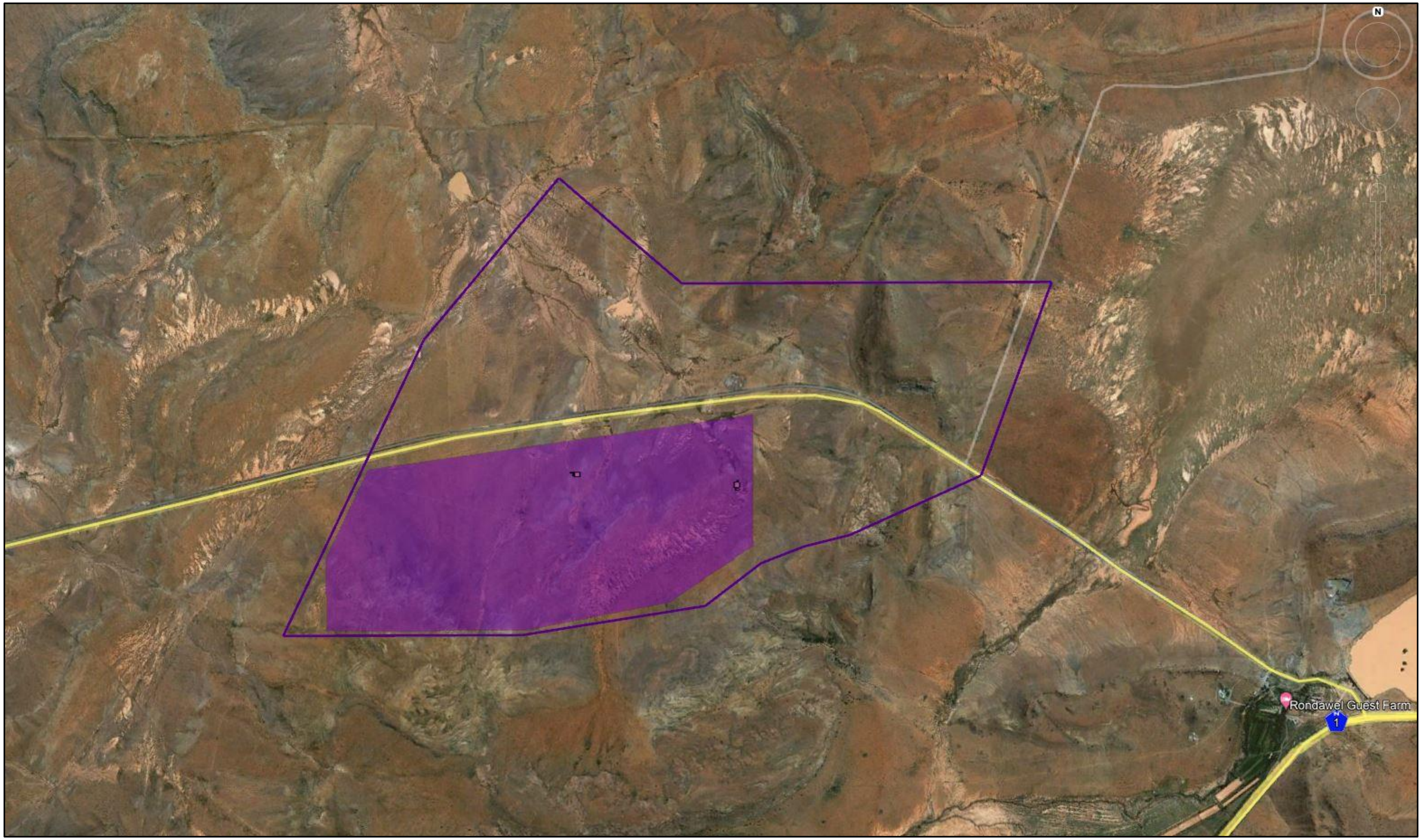


Figure 2.1. Layout of the proposed Moriri PV Facility. Shaded purple area are the PV development area, purple lines are the project boundaries.

2.1 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 wing camber and shape, exploiting functions such as agility and manoeuvrability. This adaption surpasses the static design of the bird wings in function and enables bats to utilize 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 varying 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 bat species 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, within the same population, 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 and according to O'Shea *et al*. (2003), bats may live for up to 30 years, thereby limiting the number of pups born due to this increased life expectancy. Under natural circumstances, a population's numbers may accumulate over long periods of time. This is due to the longevity and the relatively low predation of bats when compared to other small mammals. Therefore, bat populations are not able to adequately recover after mass mortalities and major roost disturbances.

2.2 Bats and photovoltaic (PV) energy facilities

Currently there is no evidence of photovoltaic (PV) facilities posing a direct threat of fatality impact on bats during operation (SABAA, 2020). However, roosting and foraging habitats may be significantly impacted during the construction phase. This is primarily due the fact that PV facilities require large areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as rocky outcrops, clumps of trees and certain vegetation being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced by PV facilities.

The presence of security lights on and around PV facilities can create significant light pollution that will impact bat feeding habits and species compositions negatively, by discouraging photophobic (light averse) species and encouraging species that readily forage around lights attracting insects.

Evidence exists of bats using polarised light at dusk to calibrate their internal magnetic compasses (Grief *et al.,* 2014), and PV solar panels are strong reflectors of horizontally polarised light (Polarised Light Pollution or PLP) which can possibly interfere with this method of navigation, additionally horizontal polarised light can mimic light reflected from water bodies **(**Szaz *et al.,* 2016). Although, the degree of impact on bats needs to be determined for bats foraging near and around their roost, since the study referenced experimented on the homing capabilities of bats released away from their roost.

3 METHODOLOGY

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.

The site is 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 the PV facility. These comparisons are done chiefly 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 are estimated for the site and the surrounding larger area, but also considers species already confirmed on site as well as from the surrounding areas.

Table 3.1: Site visit information.

Site visit dates	**First visit**	14 – 17 December 2020
	Second visit	12 – 14 April 2021
	Third visit	23 – 25 July 2021

3.1 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 sensitivity map is based partially on satellite imagery and from a site visit, 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.

Since it’s not possible to discover all bat roosts or individual roosting bats, it remains possible that bat roosts can be present in terrain not identified or anticipated as roosting habitat in the sensitivity map, subsequently the roosts may be damaged and bat fatalities may occur. This is due to the large size of renewable energy development sites as well as the elusive nature of many roosting bat species in micro roosts, as well as their capability to roost in very small inconspicuous spaces.

4 RESULTS AND DISCUSSION

4.1 Land Use, Vegetation, Climate and Topography

The proposed Moriri PV Facility is situated entirely in the **Eastern Upper Karoo** vegetation unit of the Nama Karoo Biome, with small sections of **Upper Karoo Hardeveld** situated approximately 1 – 1.5km south and south east of the site (**Figure 4.1**, Mucina & Rutherford 2012), but outside the development area. The general characteristics of the vegetation units are applicable from a bat habitat point of view.

Figure 4.1: Vegetation units present on the proposed Moriri PV Facility (Mucina & Rutherford 2012).

4.1.1 Upper Karoo Hardeveld

Upper Karoo Hardeveld is typified by steep-sloped koppies, buttes and mesas as part of the Great Escarpment. Large boulders and stones mark the landscape and it supports sparse vegetation such as dwarf Karoo scrub and drought-tolerant grasses (*Aristida*, *Eragrostis* and *Stipagrostis*).

Geologically, this vegetation unit comprises primitive and skeletal soils in a rocky landscape. These soils cover sedimentary rock such as those mudstones and arenites of the Adelaide Subgroup (Karoo Supergroup). Dolerite boulders cover slopes of the mesas and buttes found here.

The Mean Annual Precipitation of this unit ranges from 150 – 350mm per year from north west to east, and frost days are relatively high, although variable (30 – 80 days, depending on altitude).

4.1.2 Eastern Upper Karoo

Flats and gently sloping plains are found within the Eastern Upper Karoo vegetation unit and intersperse with fingers of Karoo Hardeveld on site.

Dwarf microphyllous shrubs dominate this landscape and 'white' grasses (*Aristida* and *Eragrostis* species) are prominant after good summer rains. Karoo scrub species of *Pentzia*, *Eriocephalus*, *Rosenia* and *Lycium* are important taxa (Mucina & Rutherford 2012).

Beaufort Group sandstones and mudstones are common in this vegetation unit, and some Jurassic dolerites are also to be found.

Mean annual precipitation ranges from 180 – 430mm per year (west to east), peaking in March, and as for Karoo Upper Hardeveld, frost incidence is high (30 – 80 days per year). Nearby, Victoria West has recorded mean maximum and minimum monthly temperatures of 37°C and -8°C respectively.

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.* 2020). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al.* 2020).

4.2 Currently Confirmed, Previously Recorded as well as Literature Based Species Probability of Occurrence

Table 4.1: Table of species that are currently confirmed on site, and/or have been previously recorded in the area and may be occurring based on literature. Roosting or foraging in the study area, the possible site-specific roosts, and their occurrence based on literature as well as recordings and observations in the surrounding area, is also briefly described (Monadjem *et al.* 2020).

Species	Common name	Occurrence in area*	Conservation status (SANBI & EWT, 2016)	Possible roosting habitat on site	Possible foraging habitat utilised on site
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed on site	Least Concern (2016 Regional Listing)	Roosts in rock crevices, hollows in trees, and behind the bark of dead trees. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types habitats.
Neoromicia capensis	Cape serotine	Confirmed on site	Least Concern (2016 Regional Listing)	Roosts in the roofs of houses and buildings, and also under the bark of trees.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. But is predominantly a medium height clutter edge forager on site.
Miniopterus natalensis	Natal long-fingered bat	Confirmed on site	Least Concern (2016 Regional Listing)	No known caves in the vicinity of the site. Small groups or individuals may roost in culverts or other hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.
Eptesicus hottentotus	Long-tailed serotine	Confirmed on site	Least Concern (2016 Regional Listing)	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Rock crevices in valleys on site.	It generally seems to prefer woodland habitats, and forages on the clutter edge. But may still forage over open terrain occasionally.

Sauromys petrophilus	Robert's flat-headed bat	Confirmed on site	Least Concern (2016 Regional Listing)	Roosts mainly in rock crevices.	It forages over a wide range of habitats and may utilise higher air spaces.
Epomophorus wahlbergi	Wahlberg's epauletted fruit bat	Literature	Least Concern (2016 Regional Listing)	Roosts in dense foliage of large, leafy trees and may travel several kilometres each night to reach fruiting trees.	Feeds on fruit, nectar, pollen and flowers. If and where available on site.
Nycteris thebaica	Egyptian slit-faced bat	Museum record from greater area	Least Concern (2016 Regional Listing)	Roosts in hollows, aardvark burrows, culverts under roads and the trunks of dead trees.	It appears to occur throughout the savannah and karoo biomes but avoids open grasslands. May possibly occur in the thickets of man-made gardens, and in aardvark burrows.
Cistugo lesueuri	Lesueur's wing-gland bat	Museum record from greater area	Least Concern (2016 Regional Listing)	It is a crevice dweller roosting in rock crevices. Exposed rocky cliffs and rocky koppies.	Areas with available drinking water. Clutter edge forager. May forage in more open terrain during suitable weather.
Rhinolophus darlingi	Darling's horseshoe bat	ACR 2018 record	Least Concern (2016 Regional Listing)	May utilise man made hollows, Aardvark burrows or hollows formed by rocky boulder koppies.	It is associated with a variety of habitats including thickets that may be found in the vegetated drainage areas.
Eidolon helvum	African straw-coloured fruit bat	Literature	Least Concern (2016 Regional Listing) (Globally Near-threatened)	It's a non-breeding migrant with sparse scattered records in the karoo.	Feeds on fruit, nectar, pollen and flowers. If and where available on site.

*Occurrence of species records based on site data collected off passive monitoring systems to date, ACR 2018 and Monadjem *et al*. 2020

4.3 Sensitivity Map

Figure 4.2 depicts the sensitive areas of the site, based on features identified to be important for foraging and roosting of the species that are most probable to occur on site. Thus, the sensitivity map is based on species ecology and habitat preferences.

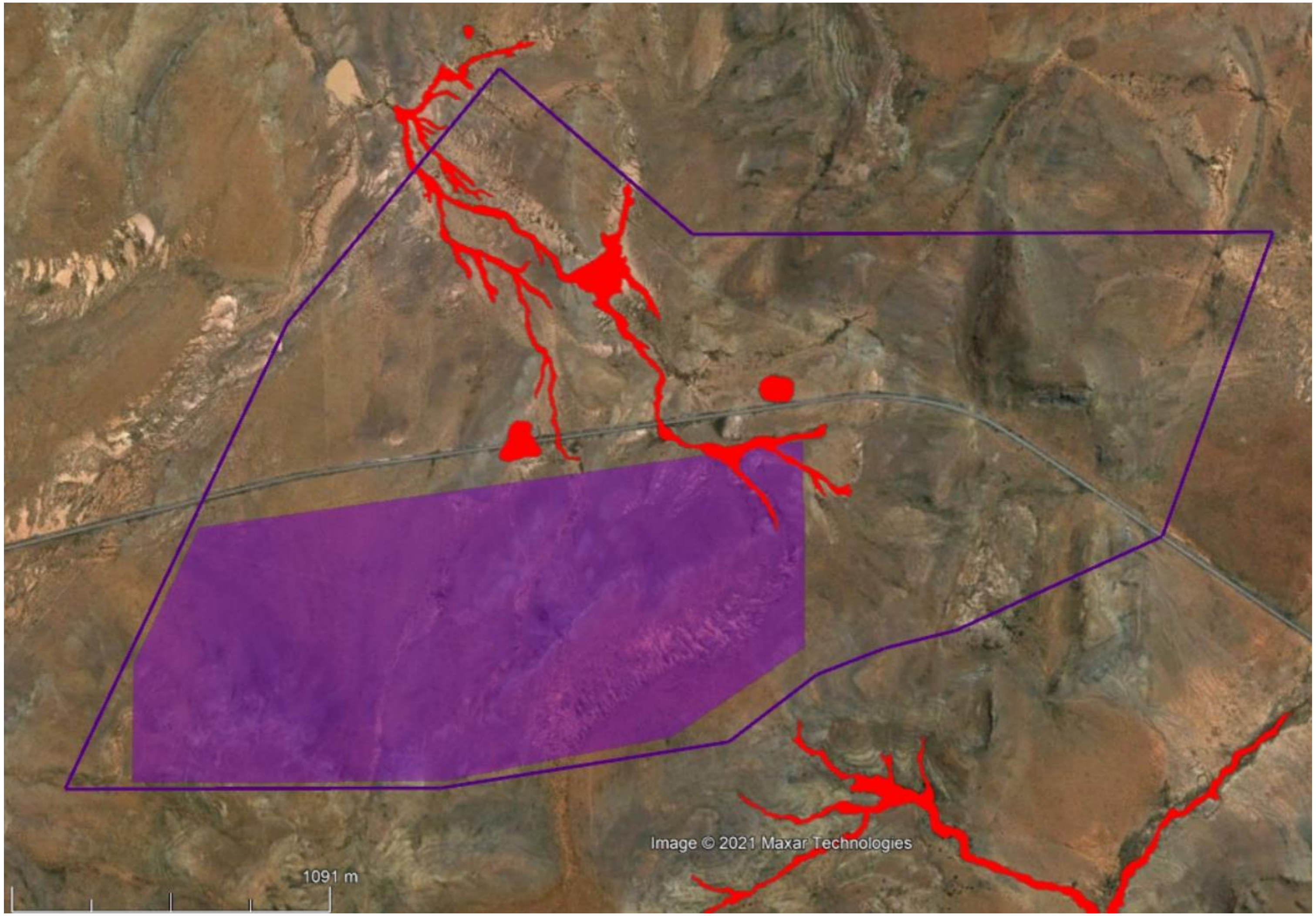
The sensitivities have been classified as high or medium, where high sensitivities no-go zones for PV panels, construction camps, substation, O&M building, the BESS and any other activity that requires earthworks or complete vegetation clearing. With the exception of access roads and underground/overhead cables (**Table 4.3**). Medium sensitivities indicate areas of probable increased risk, but PV panels are allowed to be constructed in medium sensitivity areas.

Table 4.2: Description of parameters used in the development of the sensitivity map.

Last revision	October 2021
High sensitivities	Valley bottom wetlands.
	Pans and depressions.
	Dams.
	Rocky boulder koppies (tors).
	Exposed rocky cliff edges.
	Drainage lines capable of supporting riparian vegetation.
	Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds.
Moderate sensitivities	Alluvial plains and washes.
	Seasonal drainage lines.

Table 4.3: Description of sensitivity categories and their significance in the sensitivity map.

Sensitivity	Description
High Sensitivity and its buffers	Areas that are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity/activity than the rest of the site. These areas are no-go zones for PV panels, construction camps, substation, O&M building, the BESS and any other activity that requires earthworks or complete vegetation clearing. With the exception of access roads and underground/overhead cables
Medium Sensitivity and its buffers	Medium sensitivities indicate areas of probable increased risk, but PV panels are allowed to be constructed in medium sensitivity areas.



High bat sensitivity area

Moderate bat sensitivity area

Figure 4.11: Bat sensitivity map of the site, site area indicated in a blue boundary. Sensitivity polygons are provided in .KML format with this report. Shaded purple area are the PV development area, purple lines are the project boundaries.

5 IMPACT IDENTIFICATION

Tables 5.1 – 5.4 below indicates the identified impacts associated with the proposed Moriri PV facility during the construction and operational phases. No significant impacts are identified for the decommissioning phase.

5.1 Construction phase

Table 5.1: Description of impact: foraging habitat destruction.

FORAGING HABITAT DESTRUCTION			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Potential loss of bat foraging habitat	**Direct impacts:** » Loss of habitat will potentially lead to a reduction in bat insect prey numbers. **Indirect impacts:** » A reduction of insect prey numbers may lead to increased competition for food resources, and lowered carrying capacity of the general area.	**Site**	**As per the sensitivity map**
Description of expected significance of impact: The construction of PV panels requires continuous areas to be cleared of vegetation, and in some cases earthworks and levelling. But the proposed PV development area does not intrude on large areas of High bat sensitivity, therefore the destruction of foraging habitat is not expected to be of a high significance, if the sensitivity map is adhered to.			
Recommendations with regards to possible mitigations: » Adhere to the bat sensitivity map. » Rehabilitate areas disturbed during construction, such as temporary construction camps and laydown yards.			

Table 5.2: Description of impact: Bat roost disturbance/destruction.

BAT ROOST DISTURBANCE/DESTRUCTION			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Potential disturbance/destruction of bat roosts	**Direct impacts:** » Loss of bat roosts can lead to direct mortalities of bats utilising the roost. **Indirect impacts:**	**Site**	**As per the sensitivity map**

	» A reduction of available roosting space may lead to increased competition for roosting areas and lowered carrying capacity of the general area.		
Description of expected significance of impact: During construction, bat roosts can be destroyed during earth levelling processes that involves levelling of single trees or clumps of trees, or demolishing of buildings. Bat mortalities can occur during roost destruction. The significance can be high if not mitigated.			
Recommendations with regards to possible mitigations: » Adhere to the bat sensitivity map. » Minimise blasting and earthworks.			

5.2 Operational phase

Table 5.3: Description of impact: Alteration of nocturnal bat foraging habits and bat species composition.

ALTERATION OF NOCTURNAL BAT FORAGING HABITS			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Alteration of nocturnal bat foraging habits and bat species composition.	**Direct impacts:** » Increased lights at te facility can discourage certain bat species form foraging in the area. **Indirect impacts:** » Over the long term population dynamics can be influenced by altering bat feeding habits and species compositions negatively. By discouraging photophobic (light averse) species and encouraging species that readily forage around lights attracting insects	**Site**	**As per the sensitivity map**
Description of expected significance of impact: The presence of security lights on and around PV facilities (including associated infrastructures) can create significant light pollution that will impact bat feeding habits and species compositions negatively, by discouraging photophobic (light averse) species and encouraging species that			

readily forage around lights attracting insects. This can cause local displacement of photophobic bat species, with a medium significance.
Recommendations with regards to possible mitigations: » Adhere to the bat sensitivity map. » Use lights with passive motion sensors that only switch on when a person/vehicle is nearby, if possible for safety and security reasons. » All floodlights must be down-hooded to minimise light pollution.

Table 5.4: Description of impact: Interference with bat navigation by polarised light pollution (PLP).

INTERFERENCE WITH BAT NAVIGATION BY POLARISED LIGHT POLLUTION (PLP)			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Interference with bat navigation.	**Direct impacts:** » Navigation of bats can be influenced by polarised light reflected off PV panels. **Indirect impacts:** » Long term navigation interference can discourage bats from utilising a specific area for roosting/foraging.	**Site**	**As per the sensitivity map**
Description of expected significance of impact: Evidence exists of bats using polarised light at dusk to calibrate their internal magnetic compasses, and PV solar panels are strong reflectors of horizontally polarised light which can possibly interfere with this method of navigation. Although, the degree of impact on bats needs to be determined for bats foraging near and around their roost, since the study referenced experimented on the homing capabilities of bats released away from their roost. The impact may be medium if not mitigated.			
Recommendations with regards to possible mitigations: » It is recommended that the PV solar panels be tilted away from the direction of sunset directly after sunset, to have them facing as far as possible in the opposite direction of sunset during dusk. In this way any remaining light from sunset will fall on the back of the solar panels and not at a reflective angle in relation to the low-lying sunset. If bat mortalities ae found to be unsustainably high during the operational study, a curtailment mitigation schedule may need to be implemented. » Using matte solar panels with anti-reflective coatings can also reduce the range of reflective light angles and therefore reduce PLP.			

6 POSSIBLE MITIGATION MEASURES

The primary impacts predicted for the PV facility are destruction of bat roosting and foraging habitats during construction (and to a lesser degree during decommissioning), which can lead to accidental direct bat fatalities if a roost is destroyed. Light pollution during operation due to the need for security lighting at PV facilities is also a significant predicted impact, this also includes lights used at associated infrastructure such as the substation, O&M building and BESS. Polarised light pollution has also been identified as a potential impact on bats.

Destruction of bat roosts, roosting habitat and foraging habitat:

Adhere to the sensitivity map during all phases of the facility, thus avoiding all bat sensitive areas (roosting and foraging) as well as their buffers. This also applies to temporary activities such as storage yards and construction offices. Vegetation should be allowed to recover where it was cleared after the construction and decommissioning of the facility, and where significant topsoil was removed a vegetation rehabilitation specialist must be consulted.

Since it's not possible to discover all bat roosts or individual roosting bats, it remains possible that bat roosts can be present in terrain not identified or anticipated as roosting habitat in the sensitivity map, subsequently the roosts may be damaged and bat fatalities may occur. This is due to the large size of renewable energy development sites as well as the elusive nature of many roosting bat species in micro roosts, as well as their capability to roost in very small inconspicuous spaces.

In the case of an active bat roost being discovered during construction, alternatives should be considered depending on the size and significance of the bat roost. Such alternatives in the case of a small roost may include eviction of the bats by a qualified bat specialist during the correct season when pups are not present, and under a relevant permit issued by the relevant authorities. For larger roosts, decisions on the appropriate alternatives will need to be made on a case-by-case basis in consultation with the bat fraternity, since no specific protocols on this matter currently exist in South Africa.

Disturbances of nocturnal bat foraging habits and bat species composition due to ordinary light pollution:

Only use outside security lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools that will persist every night for the entire night. Additionally, ensure all lights are down hooded, and where possible and practical utilise lights with colour temperatures that attracts less insects.

Interference with bat navigation due to polarised light pollution (PLP) :

It is recommended that the PV solar panels be tilted away from the direction of sunset directly after sunset, in order to have them facing as far as possible in the opposite direction of sunset during dusk. In this way any remaining light from sunset will fall on the back of the solar panels and not at a reflective angle in relation to the low-lying sunset. Using matte solar panels with anti-reflective coatings can also reduce the range of reflective light angles and therefore reduce PLP.

7 CONCLUSION

This Bat Impact Assessment Scoping Report considered information gathered from three site visits, literature, and satellite imagery. No further data gathering is required for the EIA phase, and impacts identified during the scoping phase will be evaluated and rated in more detail during the EIA phase, based on refinements made to the proposed PV facility layout and infrastructure.

The sensitivities have been classified as high or medium, where high sensitivities no-go zones for PV panels, construction camps, substation, O&M building, the BESS and any other activity that requires earthworks or complete vegetation clearing. With the exception of access roads and underground/overhead cables. Medium sensitivities indicate areas of probable increased risk, but PV panels are allowed to be constructed in medium sensitivity areas.

The main possible impacts identified includes foraging and roosting habitat destruction due to earthworks and vegetation clearing, species composition alteration due to normal light pollution, and bat navigation interference due to polarised light pollution (PP).

The destruction of foraging and roosting habitat can be mitigated by adhering to the sensitivity map.

The presence of security lights on and around PV facilities (including associated infrastructures) can create significant light pollution that will impact bat feeding habits and species compositions negatively, by discouraging photophobic (light averse) species and encouraging species that readily forage around lights attracting insects. This can cause local displacement of photophobic bat species, with a medium significance. This can be mitigated by using outside security lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools that will persist every night for the entire night. Additionally, ensure all lights are down hooded, and where possible and practical utilise lights with colour temperatures that attracts less insects.

Evidence exists of bats using polarised light at dusk to calibrate their internal magnetic compasses, and PV solar panels are strong reflectors of horizontally polarised light which can possibly interfere with this method of navigation. Although, the degree of impact on bats needs to be determined for bats foraging near and around their roost, since the study referenced experimented on the homing capabilities of bats released away from their roost. The impact may be medium if not mitigated. This can be mitigated by tilting PV solar panels be away from the direction of sunset directly after sunset, in order to have them facing as far as possible in the opposite direction of sunset during dusk. In this way any remaining light from sunset will fall on the back of the solar panels and not at a reflective angle in relation to the low-lying sunset. Using matte solar panels with anti-reflective coatings can also reduce the range of reflective light angles and therefore reduce PLP.

Thus far, from a bat impact perspective, no reasons have been identified for the Moriri PV facility not to proceed to the EIA phase.

8 REFERENCES

ACR. 2020. African Chiroptera Report 2020. V. Van Cakenberghe and E.C.J. Seamark (Eds). *AfricanBats NPC*, Pretoria. i-xviii + 8542 pp.

Greif, S., Borissov, I., Yovel, Y., Holland R.A. 2014. *A functional role of the sky's polarization pattern for orientation in the greater mouse-eared bat.* Nat Commun 5, 4488 (2014). https://doi.org/10.1038/ncomms5488.

Hester, S. G. and Grenier, M.B. 2005. *A conservation plan for bats in Wyoming*. Lander, WY: Wyoming Game and Fish Department, Nongame Program.

Monadjem, A., Taylor, P.J., Cotterill, F.P.D. & Schoeman, M.C. 2020. Bats of southern and central Africa – (Second Edition) A biogeographic and taxonomic synthesis, Wits University Press.

Mucina, L. and Rutherford, M. C. 2012. The Vegetation of South Africa, Lesotho and Swaziland-*Strelitzia 19,* South African National Biodiversity Institute, Pretoria.

Neuweiler, G. 2000. *The Biology of Bats*. Oxford University Press.

O'Shea, T. J., Bogan, M. A. and Ellison, L. E. 2003. Monitoring trends in bat populations of the United States and territories: Status of the science and recommendations for the future. *Wildlife Society Bulletin*, 31: 16-29.

Rautenbach, I.L. 1982. *Mammals of the Transvaal*. Pretoria: Ecoplan.

Szaz, Denes & Mihályi, Dávid & Farkas, Alexandra & Egri, Adam & Barta, András & Kriska, Gyorgy & Robertson, Bruce & Horváth, Gábor. 2016. *Polarized light pollution of matte solar panels: anti-reflective photovoltaics reduce polarized light pollution but benefit only some aquatic insects*. Journal of Insect Conservation. 20. 10.1007/s10841-016-9897-3.

Taylor, P. J. 2000. Bats of southern Africa, University of Natal Press, Pietermaritzburg.

Tuttle, M. D. and Hensley, D. L. 2001. *The Bat House Builder's Handbook*. (BCI) Bat Conservation International.

Werner Marais
Zoologist and Ecologist
MSc Biodiversity & Conservation
Pr.Sci.Nat. – SACNASP registration no. 400169/10
(Zoological Science)

DISCLAIMER

The services carried out and reported in this document have been done as accurately and scientifically as allowed by the resources and knowledge available to Animalia Consultants (Pty) Ltd at the time on which the requested services were provided to the client. Animalia Consultants (Pty) Ltd reserves the right to modify aspects of the document including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although great care and pride have been taken to carry out the requested services accurately and professionally, and to represent the relevant data in a clear and concise manner; no responsibility or liability will be accepted by Animalia Consultants (Pty) Ltd. And the client, by receiving this document, indemnifies Animalia Consultants (Pty) Ltd and its staff against all claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by Animalia Consultants (Pty) Ltd; and by the use of the information contained in this document. The primary goal of Animalia's services is to provide professionalism that is to the benefit of the environment as well as the community.