Bat Sensitivity Assessment

- **For the proposed Paulputs CSP facility near Pofadder, Northern Cape**

Compiled by: Werner Marais

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PREPARED FOR:

Savannah Environmental Pty (Ltd)
PO Box 148
Sunninghill
2157
Tel: +27 11 234 6621
www.savannahSA.com

By

2015/364493/07

Heldervue
Somerset West
Cape Town
7130
☎+27 78 190 3316

✉werner@animalia-consult.co.za

www.animalia-consult.co.za

Ref: R-1606-40

Appointment of Specialist

Specialist Company:	Animalia Zoological & Ecological Consultation (Pty) Ltd
Fieldwork conducted by:	Werner Marais
Report done by:	Werner Marais
Appointed by:	Savannah Environmental (Pty) Ltd
For:	Bat impact assessment for the proposed Pauputs CSP facility near Pofadder, Northern Cape

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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 additional attention to those listed as Threatened or Protected.

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1 INTRODUCTION

This is a Bat Sensitivity Assessment that aims to determine the likelihood and most likely causes of bat impacts at the proposed Paulputs 8 CSP facility.

The proposed Paulputs CSP 200MW development is proposed to be located on the farm Scuit-klip 92 Portion 4, near Pofadder in the Northern Cape. The facility proposes to include the following infrastructure:

- Molten salt tower up to 300m in height with surrounding heliostat field
- Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
- On-site project substation, and short 132 kV power line to Eskom's existing Paulputs Transmission Substation
- Water supply abstraction point located at the Gariep River close to Onseepkans, Filter and booster station at abstraction point
- Water supply pipeline along R357 Onseepkans Road to the site
- On-site lined ground water storage reservoir and various steel water tanks
- Lined evaporation ponds, Packaged water treatment plant and associated chemical store
- Auxiliary wet cooled chiller plant
- Control room and office building, Heliostat assembly building and workshop.

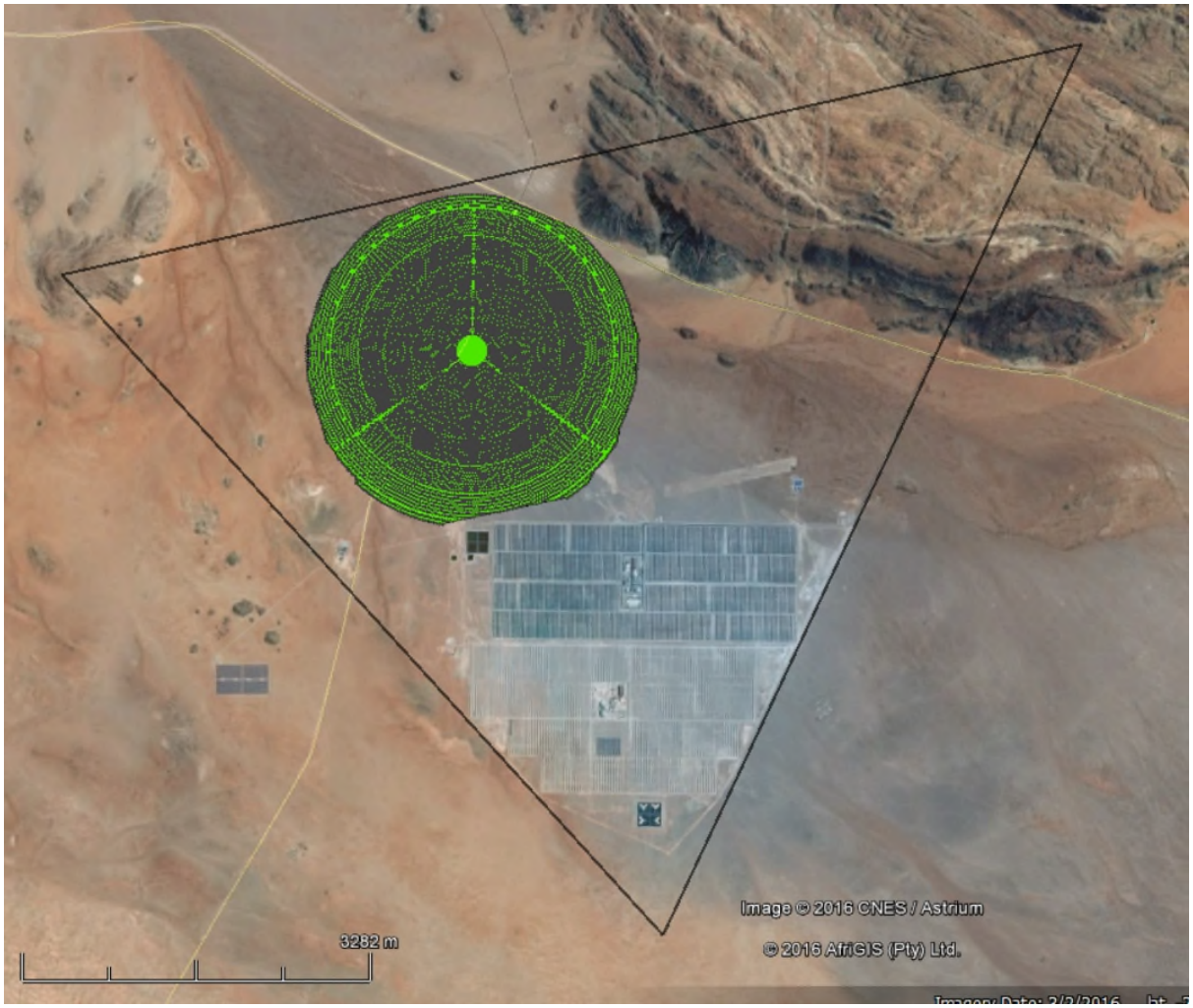

Figure 1: Location of the study area where the proposed Pualputs CSP development is proposed.

2 OBJECTIVES AND TERMS OF REFERENCE FOR BAT MORTALITY POTENTIAL ASSESSMENT

- Describe habitats and terrain features on site applicable to bats.
- Perform a desktop assessment of the bat species assemblage and diversity on site.
- Identify the bat sensitivity risk of the site for a Tower CSP development.
- Determine the possible causes for potential bat mortalities based on experience at operational CSP facilities both in South Africa and internationally.
- Consider the proposed structural features of the proposed facility that may pose a threat to bats and provide an assessment of the potential impacts on bats as a result of the development.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

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 dependence of a bat on each of these factors depends on 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 study area 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 CSP facility. These comparisons are done chiefly by studying the geographic literature of each site, available satellite imagery and observations during the study area visit. Species probability of occurrence based on the above mentioned factors are estimated for the identified study area and the surrounding larger area.

3.1 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 life styles, 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 amount 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.

3.2 Land Use, Vegetation, Climate and Topography

The study area is covered by two different vegetation units (Figure 2).

- The **Bushmanland Arid Grassland** is considered to be Least Threatened, however only less than 1% of this vegetation type is currently protected in South Africa. Tussock grasses and dwarf shrubland dominate this vegetation type with no endemic plants present. Shallow lime-rich soils support the plant life and underneath the soil are the Ecca and Beaufort geological groups. The summers are hot and dry with an average daily maximum of 36°C, while winters are icy cold with an average daily minimum of 4°C. The average annual rainfall is only 189mm with peaks in late autumn and early summer, but varies

considerably from year to year (Mucina& Rutherford, 2006). The actual Pauputs as well as all heliostats are proposed within this vegetation unit and the Gordonia Duineveld.

- The **Lower Gariep Broken Veld** vegetation unit consists of hills and low mountains, slightly irregular plains and some rugged terrain. The vegetation is sparse and is dominated by shrubs and dwarf shrubs with widely scattered low trees. The mean annual precipitation ranges from 70mm to 240mm, with mean maximum and minimum temperatures of 39.7°C and -4.1°C for January and July respectively. The unit has a least threatened conservation status (Mucina and Rutherford 2006).

3.3 Bat Species likely to occur within the study area

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 1**. There are no houses or buildings located within close proximity of the proposed development site.

Bat species with a geographical distribution that includes the current study area are listed in **Table 2**.

Table 1: Potential of the vegetation within the study area to serve as suitable roosting and foraging areas for bats.

Vegetation Unit	Roosting Potential	Foraging Potential	Comments
Bushmanland Arid Grassland	Low	Low	The flat relatively featureless terrain does not offer ample roosting or foraging habitat.
Lower Gariep Broken Veld	Moderate - High	Low - Moderate	The vegetation unit present roosting potential in the form of rock crevices and associated hollows. The unit may provide adequate foraging opportunities, especially during adverse weather conditions (e.g. very windy conditions).

Table 2: Table of species that may be roosting or foraging in the study area and the roosts generally used (Monadjem *et al.* 2010).

Species name	Common name	Probability of Occurrence (%)	Conservation Status	Possible roosting sites occupied on site
Cistugo seabrae	Angolan wing-gland bat	40-50	Near Threatened	It is restricted to the arid western parts of southern Africa, typically in desert and semi-desert conditions
Miniopterus natalensis	Natal long-fingered bat	90 - 100	Near Threatened	Cave-dependent. No known caves in vicinity of site, however mountainous terrain within the area map may provide caves
Neoromicia capensis	Cape serotine	90 - 100	Least Concern	Roosts in bark of trees, at the base of aloe leaves, under roofs.
Rhinolophus clivosus	Geoffroy's horseshoe bat	40 - 50	Least concern	Roosts in caves and rock hollows associated with arid savannah, woodland and riparian forest. Mountainous nature of area may provide rock hollows
Sauromys petrophilus	Roberts's flat-headed bat	90-100	Least Concern	Roost in narrow cracks and under slabs of exfoliating rock. Species is closely associated with rocky habitats in dry woodland, mountain fynbos or arid scrub
Tadarida aegyptiaca	Egyptian free-tailed bat	90 - 100	Least concern	Roosts in caves, crevices, hollow trees, buildings, and any other suitable crevices.

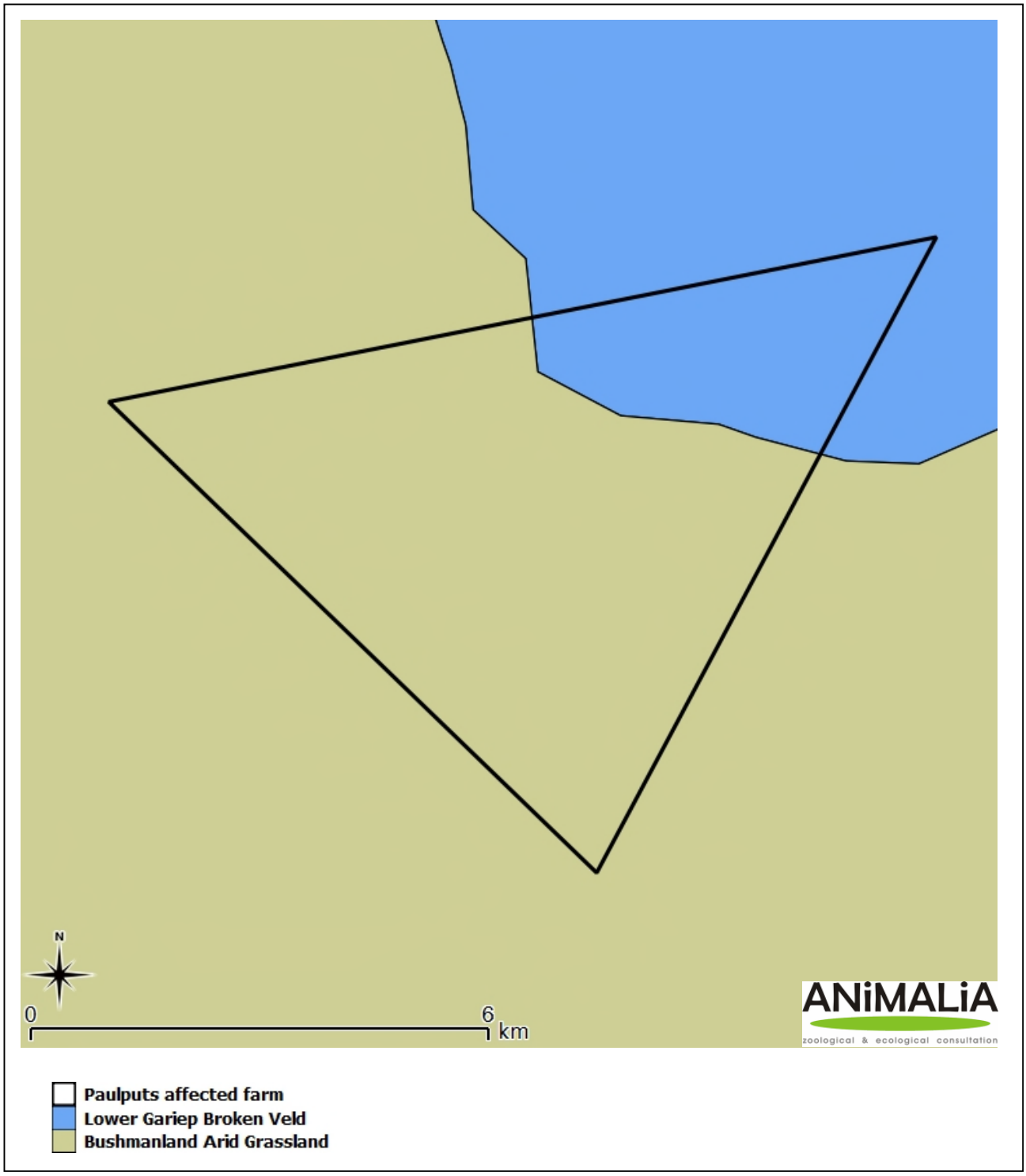

Figure 2: Vegetation units present within and around the study area (Mucina and Rutherford 2006).

4 METHODOLOGY

The study included a desk-top review of existing monitoring data from an operational facility within the United States as well as a site visit of a functional CSP Tower facility near Upington (located approximately 40km to the west of the site), which took place on 2 June 2016. The purpose of this was to identify potential impacts which may arise as a result of the proposed Paulputs Project. During the site visit, the structural design of the facility was investigated and relevant staff were questioned on the specific details of known bat mortalities at the functional CSP facility, in order to determine the possible causes of the bat mortalities. Special attention was paid to potential points of contact for a bat with very hot surfaces or steam. A brief visit to the proposed development site was undertaken in order to characterise the existing environment and identify the potential for bats to occur within the study area.

4.1 Assumptions and Limitations

Distribution maps of South African bat species still require further refinement such that the bat species with the potential to occur on the site are assumed accurate. If a species has a distribution marginal to the study area, it was assumed to occur in the area. The literature based table of species which could potentially occur in the study area (Table 2) may include a higher number of bat species than actually present.

The migratory paths of bats are largely unknown, thus limiting the ability to determine if the development will have a large scale effect on migratory species.

In determining the potential causes of bat mortalities at the functional CSP Tower design, assumptions and conclusions were made based on the accounts and details of the mortality events as described by the relevant staff, as well as observations made of the applicable structures. No bat mortalities were observed or investigated directly by the specialist.

5 RESULTS AND DISCUSSION

5.1 Potential Impacts on bats associated with Solar Thermal Plants

Potential impacts on bats as a result of the proposed CSP Tower 8 Facility could include:

- Reductions in the extent of bat foraging and roosting habitat
- Mortality as a result of the interaction with the proposed infrastructure

i. Reductions in the extent of bat foraging and roosting habitat

As indicated previously, the development site is located completely within the Bushmanland Arid Grassland. The flat relatively featureless terrain of this vegetation type within the study area does not offer ample roosting or foraging habitat and therefore, there is a low likelihood that this impact will occur.

ii. Mortality as a result of the interaction with the proposed infrastructure

Results of international and local monitoring indicate that bat interactions with thermal solar facility infrastructure are associated with **the air-cooled condenser, with bat** mortalities being recorded within or in close proximity to this infrastructure. The mechanism of cooling the steam at the local facility allows for the hot steam to be openly blown onto the condenser, inside the steam condenser building. This mechanism in combination with the condenser building being accessible to bats, is what allowed for the bats to get in contact with hot steam, which was the cause of the mortalities. The mortalities recorded at this site are most likely to be almost exclusively of the species *Tadarida aegyptiaca* (Egyptian Free-tailed bat) with very few that may have been *Neoromicia capensis* (Cape Serotine bat), both of which could potentially occur within the larger study area (i.e. along the Gariep River). It must be noted that bat fatalities at this site were recorded on only one occasion, prior to full operation of the facility.

In the case of the Paulputs facility, the following is of relevance regarding the infrastructure:

- The cooling system used is based on an Air Cooled Condenser, which is a widely used technology for all kind of power plants. The steam is a completely closed system.
- There are other structures with high temperatures. These are to be appropriately thermally isolated. Any openings to the central tower and pipe extractions are to be closed with a grid to prevent birds or bats entering these areas.
- The tower will be monitored with thermal cameras. There will be no significant heat loss at night at top of the solar flux tower. The tower will be completely drained on a daily basis before the sunset. The receiver will quickly cool.

The risk of mortality as a result of interactions with the solar facility infrastructure (such as the ACC) is therefore considered to be low as there is little potential for bats to come into contact with heated surfaces and/or steam.

iii. Cumulative impacts

CSP facilities which are proposed in the area have a very high probability of being located within the Bushmanland Arid Grassland or similar type of habitat which have a low potential for bat roosting and foraging habitat. The expected cumulative impacts associated with loss of habitat are therefore considered to be limited.

The risk of mortality as a result of interactions with the solar facility infrastructure (such as the ACC) at the Paulputs Facility is considered to be low as there is little potential for bats to come into contact with heated surfaces and/or steam. Therefore, the contribution of this project to cumulative impacts is expected to be limited.

6 IMPACT ASSESSMENT

6.1 Reductions in the extent of bat foraging and roosting habitat.

Impact Nature: Some roosting and foraging habitat will be lost by means of the construction the facility.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Low (28)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation:

The development is proposed within a habitat with mostly low foraging and roosting potential, it should remain within this habitat as the preferred location.

Cumulative Impacts:

CSP facilities which are proposed in the area have a very high probability of being located within the Bushmanland Arid Grassland or similar type of habitat which have a low potential for bat roosting and foraging habitat. The expected cumulative impacts associated with loss of habitat are therefore considered to be limited.

Residual Impacts:

The impacted habitat cannot be rehabilitated to a state that is completely similar to preconstruction, however the roosting and foraging potential of the impacted habitat is low and therefore the residual impacts reduction of foraging and roosting habitat is also considered to be low.

Cumulative impact: Reductions in the extent of bat foraging and roosting habitat across all CSP facilities which may be proposed in the area.		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (4)
Significance	**Medium (40)**	**Medium (32)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The developments are proposed within habitats with mostly low foraging and roosting potential, it should remain within these habitats as the preferred locations.		

6.2 Mortality as a result of the interaction with the proposed infrastructure

Impact Nature: Bat mortalities may occur due to interaction with potentially harmful infrastructure (e.g. contact with hot steam), if such infrastructure is not adequately closed up.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Minor (2)
Probability	Highly Probable (4)	Very Improbable (1)
Significance	**Medium (52)**	**Low (5)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation:		

Buildings housing steam condensers and other hot surfaces/liquids should be closed up thoroughly and have no overhanging roofs or overlapping sheets with holes of 1.5cm or more in diameter.
Cumulative Impacts: Mortalities due to a lack of mitigation across several CSP facilities that may be proposed in the area, can result in a significant decline of local bat populations.
Residual Impacts: Local bat populations, if impacted in significantly, have a slow recovery rate due to bats having a low level of annual reproduction.

Cumulative impact: Local bat populations, if impacted in significantly, have a slow recovery rate due to bats having a low level of annual reproduction.		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Minor (2)
Probability	Highly Probable (4)	Very Improbable (1)
Significance	**Medium (52)**	**Low (5)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: On all CSP facilities, including tower and parabolic through types, buildings housing steam condensers and other hot surfaces/liquids should be closed up thoroughly and have no overhanging roofs or overlapping sheets with holes of 1.5cm or more in diameter.		

7 CONCLUSION

Potential impacts on bats as a result of the proposed Paulputs Facility could include:

- Reductions in the extent of bat foraging and roosting habitat
- Mortality as a result of the interaction with the proposed infrastructure

Impacts are expected to be limited as a result of the limited potential of the vegetation on the site to provide foraging and roosting habitat as well as a result of the proposed design of the facility.

As impacts of solar thermal facilities on bats is poorly understood, it is considered important to document any impacts which may be identified during operation. It is recommended that any bat carcasses recorded are also documented during operational bat monitoring and the cause of such mortality investigated by an appropriate specialist.

As is proposed for the facility design, buildings housing steam condensers should be closed up thoroughly and have no overhanging roofs or overlapping sheets with holes of 1.5cm or more in diameter.

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Werner Marais

Zoologist and Ecologist

MSc (Biodiversity & Conservation, UJ)

Pr.Sci.Nat. – SACNASP

(Zoological Science)

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