Bat Sensitivity Assessment

- **For the proposed Ilanga Tower 7 CSP facility near Upington, Northern Cape**

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For:	Bat impact assessment for the proposed Ilanga Tower 7 CSP facility near Upington, Northern Cape

Independence:

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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 Ilanga Tower 7 CSP facility.

The Ilanga Tower 7 CSP 150MW development forms part of the Karoshoek Solar Valley Development located approximately 30 km east of Upington, and will be constructed over an area of approximately 1519.19 ha in extent within the broader property. The project is proposed to be developed on Portion 2 of the Farm Matjiesrivier 41 and Portion 4 of the Farm Trooilaps Pan 53, located approximately 30 km east of Upington within the //Khara Hais Local Municipality (ZF Mgcawu (previously Siyanda) District Municipality) and the !Kheis Local Municipality in the Northern Cape.

The facility will include the following infrastructure:

- Central tower up to 270m with a molten salt receiver on top of the tower.
- Waste management infrastructure including evaporation dams and a wastewater treatment facility.
- Access roads to the site and internal access roads;
- On-site substation and associated 132kV power line linking the facility to the Karoshoek Solar Valley substation or to the national electricity grid;
- Karoshoek Solar Valley substation and associated power lines 132 – 400kV lines connecting to the National Grid;
- A water supply pipeline from the Orange River (including water treatment and storage reservoirs);
- Operational buildings, including offices and workshops;
- The solar collector field consisting of heliostats, all systems and infrastructure related to the control and operation of the heliostats;
- The power block/power island comprising of a conventional steam turbine generator with an ACC and associated feed water system;
- Molten Salt Circuit which includes the thermal storage tanks for storing low and high temperature liquid salt, a central solar thermal tower receiver, pipelines and molten salt to steam heat exchangers;
- Auxiliary facilities and infrastructure consisting of the switch yard, step up transformers, up to 132 kV power evacuation lines, access routes, water supplies and facility start up generators.

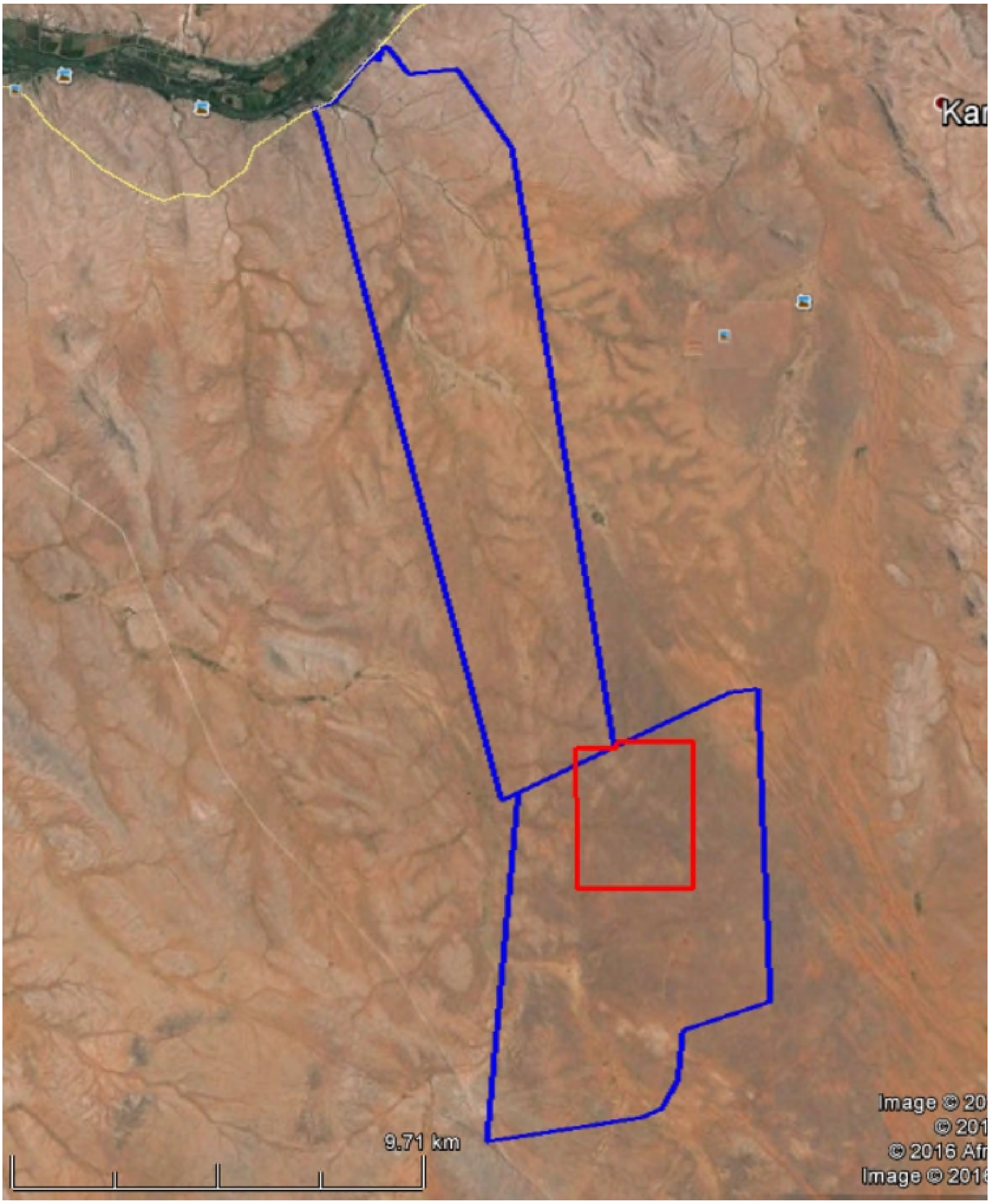

Figure 1: Location of the study area where the proposed Ilanga Tower 7 CSP development is proposed.

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 or near four different vegetation units (Figure 2).

- The **Bushmanland Arid Grassland** is considered to be Least Threatened, with 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 Ilanga Tower 7 as well as all heliostats are proposed within this vegetation unit and the Gordonia Duineveld.

- The **Gordonia Duineveld** and its landscape consists of parallel dunes about 3 – 8m high, open shrubland and ridges of grassland. Very little exposed rocks are present in the sand dunes. Rainfall peaks during summer and autumn with very dry winters, the average annual rainfall is 120 – 260mm and mean minimum and maximum temperatures 41.5°C and -4°C. The actual Ilanga Tower 7 as well as all heliostats are proposed within this vegetation unit and the Bushmanland Arid Grassland.
- The **Kalahari Karroid Shrubland** has flat gravel plains with low karroid shrubland. On site very little exposed rock are visible and the vegetation unit is dominated by red sandy soils. The average annual rainfall is 100 – 200mm with peaks in summer and autumn, and the winters are very dry. Mean minimum and maximum temperature range is 39.5°C – 4.2°C.
- The riparian and alluvial vegetation of the **Lower Gariep Alluvial Vegetation** along the Orange River located ~10km to the north of the site, as well as the presence of open surface water (i.e. the Gariep River) can present foraging and drinking habitat for bats.

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.
Gordonia Duneveld	Low	Low - Moderate	The undulating dunes can offer some shelter from wind and other elements, but roosting space is low and vegetation sparse.
Kalahari Karroid Shrubland	Low	Moderate	Roosting space is low but the denser vegetation and some floristic elements can offer habitat for insect prey.
Lower Gariep Alluvial Vegetation	Low	High	The availability of open surface water in combination with ample insect prey offers ample foraging opportunities for bats.

Table 2: Bat species with a geographical distribution that includes the current study area

Common name	Taxon	Habitat	National status	Likelihood of occurrence
Darling's horseshoe bat	*Rhinolophus darlingii*	Arid areas but require caves or rock crevices	NT	LOW, on edge of distribution; suitable probably does not occur on site.
Dent's horseshoe bat	*Rhinolophus denti*	Savanna woodland species but requires caves	NT	LOW, on edge of distribution; suitable habitat may occur on site or may be vagrant from Gariep River valley.
Cape Serotine Bat	*Pipistrellus capensis*	Wide habitat tolerances, but often found near open water	LC	Suitable habitat may occur along Gariep River.
Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	In arid areas. often associated with water sources	LC	Suitable habitat may occur along Gariep River.
Egyptian Slit-faced Bat	*Nycteris thebaica*	Wide habitat tolerance	LC	Moderate-High
Straw-coloured fruit bat	*Eidolon helvum*	Occasional migratory visitors within southern Africa	LC	Low

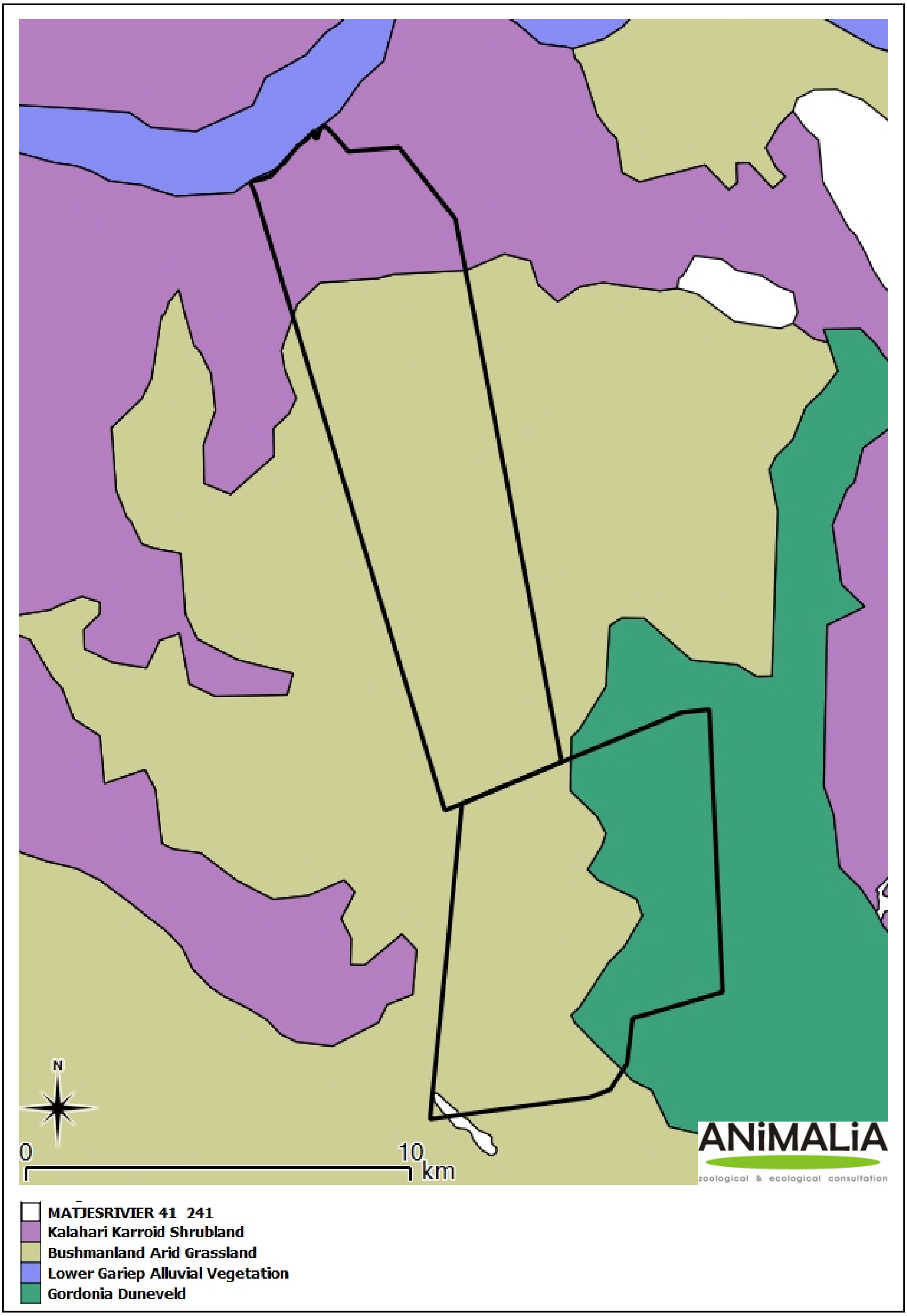

Figure 2: Vegetation units present within and around the study area (Mucina and Rutherford 2006).

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 Ilanga CSP Tower 7 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 7 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 within the Bushmanland Arid Grassland and Gordonia Duineveld. The flat relatively featureless terrain of these vegetation types 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 Ilanga Tower 7 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 as part of the Karoshoek Solar Valley Development are located within Bushmanland Arid Grassland and Gordonia Duneveld, both of which have a low potential for bat roosting and foraging habitat. The 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 Ilanga CSP Tower 7 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	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (18)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Not required	
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 as part of the Karoshoek Solar Facility are located within Bushmanland Arid Grassland and Gordonia Duneveld, both of which have a low potential for bat roosting and foraging habitat. The 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 are proposed as part of the Karoshoek Solar Facility.		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (20)**
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 as part of the Karoshoek Solar Valley Development can result in a decline of local bat populations. However, with the implementation of appropriate mitigation, this impact can be reduced to low.
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 CSP Tower 7 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 are 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 bird 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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