Specialist EIA Assessment with regards to bat (Chiroptera) sensitivity

- **For the proposed Kangnas Wind Energy Facility, near Springbok, Northern Cape**

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Scope of the Study

- A brief description of the existing land use of the site and its associated impacts.
- The vegetation units of the site will be described with regards to their respective bat roosting and foraging potentials.
- An explanation of South African bats and the effects of wind turbines on bats as well as a literature based table of species probability of occurrence on the site.
- Spatial representation of bats that were detected on the site during field work.
- Indication of the possible roosting and foraging habitats/areas on site.
- Indication of the bat sensitive areas.
- Discussion of the foreseen impacts of the development and their suggested mitigation measures or recommendations.

Appointment of Specialist

Animalia Zoological & Ecological Consultation CC was appointed by Aurecon South Africa (Pty) Ltd to undertake a specialist EIA phasebat sensitivity study for the proposed Kangnas Wind Energy Facilityin the Northern Cape. The fieldwork data gathering component was conducted by Monika Moirand overseen and reviewed by Werner Marais, the report was also compiled by Werner Marais(CV's available on request).

Independence:

Animalia Zoological & Ecological Consultation CC has no connection with the developer. Animalia Zoological & Ecological Consultation CC is not a subsidiary, legally or financially, of the developer; remuneration for services by the developer in relation to this proposal 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 authorization of this project.

Applicable Legislation:

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

- NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004; section 97): THREATENED OR PROTECTED SPECIES REGULATIONS: All bats enjoy protection under this act. This act also calls for an environmental impact assessment for threatened and protected species.
- NORTHERN CAPE NATURE CONSERVATION ACT: SCHEDULE 1 & 2 (ACT 9 OF 2009): Schedule 1 lists Specially Protected species in the Province, with no bats listed. Schedule 2 lists Protected species which includes very common and general bat species as well as species not occurring within the Northern Cape.

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1. INTRODUCTION

1.1 Study Area

South Africa Mainstream Renewable Power Developments (Pty) Ltd (MRP) proposes to construct a 750 MW wind energy facility and a 250 MW solar photovoltaic energy facility on farms near Springbok in the Northern Cape (Kangnas site). The proposed project would take place on Farm Kangnas (Farm No. 77 Portion 3 and the Remainder), Farm Koeris (Farm No. 78 Portion 1), Farm Areb (Farm No. 75 Portion 0 and Remainder) and Farm Smorgenschaduwe (Farm No. 127 Portion 0 and Remainder) in the Northern Cape.These farms are located approximately 48 km east of Springbok and are accessed via the N14(**Figure 1**).The five farms cover an area of approximately 46 535 ha (Aurecon, 2012).

The site is 89.5km and 86.7km north-east of the Namaqua National Park and Skilpad and Namaqua National Park, respectively, and approximately 22 km east of the Goegap Nature Reserve. The terrain consists of relatively flat terrain with rocky elevations and mountainous areas in the north-west of the site. These rocky elevations reach the highest elevation of approximately 180m in comparison to most of the surrounding flat terrain. Gulleys and drainage channels are relatively absent from the site and vegetation is sparse (**Figure 2**). Sustainable water sources are not evident.

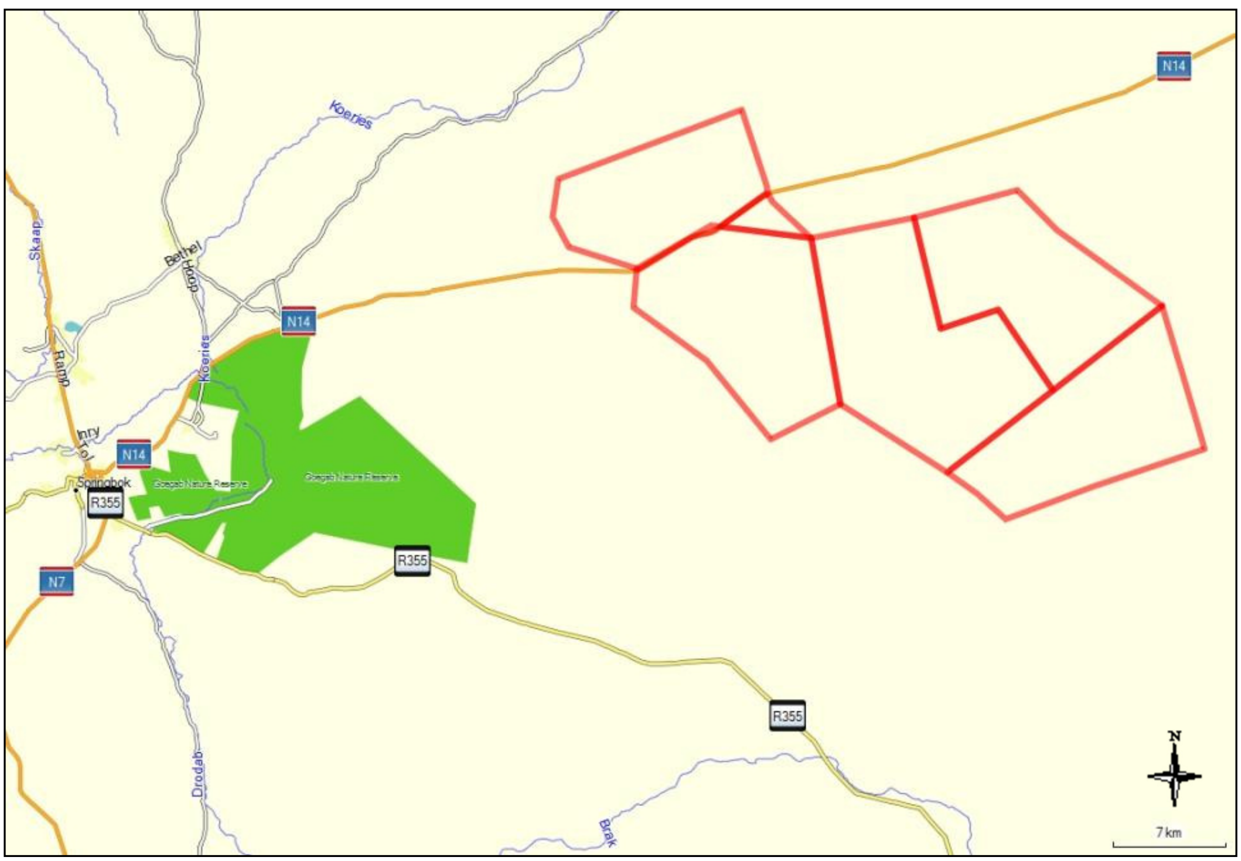
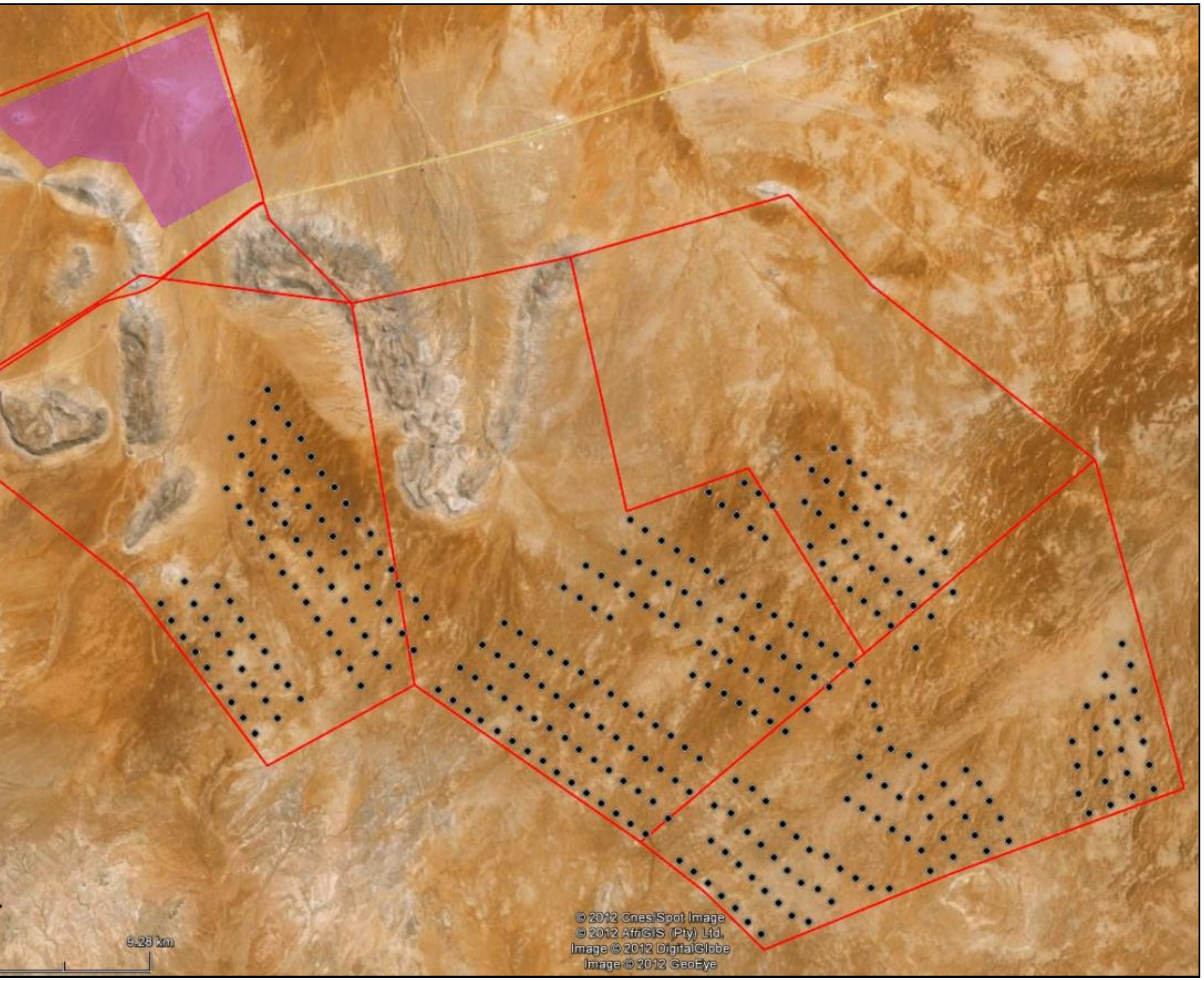


Figure 1: Map with an indication of the **Kangnas** site (red outline).



e of the **Kangnas** site; the site perimeter is indicated in red, approximate proposed turbine locations as black dots and

1.2 Land use and existing impacts on the study area

There are no direct impacts on the study siteapart from some farm buildings. The impacts on the natural vegetation for all four sites is predominantlylimited to livestock grazing as no agricultural fields were observed.

1.3 Vegetation units, geology and climate

Majority of the Kangnas site occupies the vegetation unit of Bushmanland Arid Grasslandwithin the Nama Karoo biome (**Figure 3**).The site occupies the western part of the vegetation unit, characterized by extensive plains on a slightly sloping plateau interspersed with few rocky outcrops. These rocky outcrops may prove useful as bat roosting sites. The substrate ranges from sandy to stony and sparsely-vegetated sand dunes. The Bushmanland Arid Grassland is sparsely dominated by "white" grasses such as *Stipagrostis* spp. and *Salsola* shrub, giving it a semi desert character. In years of high precipitation rates, rich displays of annual herbs appear. Mean monthly maximum and minimum temperatures are 40.6°C and -3.7°C in January and July, respectively. The minimum monthly amount of precipitation has been recorded at around 6 mm in January and a high of 54mm in July. The area has a low agricultural potential due to low rainfall and limited grass cover. This unit has been categorized as Least Threatened with 0.4% currently protected in the Augrabies Falls National Parks and Goegap Nature Reserve. 99.4% of the vegetation unit remains such that very little of the unit has been transformed by anthropogenic activities. This unit has a low potential of being utilised by bats for foraging and a very low potential for providing roosting space (Table 1).

The west and north-west section of the Kangnas site falls on the Bushmanland Inselberg Shrubland vegetation unit within the Richtersveld bioregion of the Succulent Karoo biome. The area is dominated by a plain of desert grasslands spotted with inselbergs (an isolated hill or mountain, often heavily eroded on its lower slopes). These Inselbergs can prove useful as roosting sites. The area is considered to be of a non-soil land class due to the substrate consisting of rock with limited soils. These substrate characteristics restrict land-use options. The unit possesses a rich composition of succulent plant taxa of the families Mesembryanthemaceae, Asphodelaceae, Crassulaceae, Euphorbiaceae and Zygophyllaceae. These plants may provide limited foraging areas suitable for insectivorous bats. The vegetation unit has been categorized as Least Concern as 99.8% of the unit has remained unchanged. This unit has a moderate potential of being utilised by bats for foraging and roosting (Table 1).

South and south west of the site boundary is the Platbakkies Succulent Shrubland vegetation unit of the Namaqualand Hardeveld bioregion. Platbakkies Shrubland supports at least five endemic succulents (*Lithops* and *Conophytum* spp) and two endemic geophytes (Helme & Desmet, 2006). This unit may support limited foraging activities of insectivorous bats. The soil is porous with a high drainage capacity. The area was classed as a Least Concern conservation category as 99.3% of the unit remains unchanged

(Mucina & Rutherford, 2006). This unit has a low potential of being utilised by bats for foraging and roosting (Table 1).

South west of the site an area is occupied by the Namaqualand Klipkoppe Shrubland vegetation unit of the Namaqualand Hardeveld bioregion. This vegetation unit occurs at an altitude of 300m to 800 m. The landscape consists of large granite and gneiss domes, boulder koppies and valleys. The Klipkoppe Shrubland vegetation unit possesses shallow soils covering hard rock. The vegetation consists of a mix of succulent and woody shrubs. The dominant succulent species include *Ruschia viridifolia* and *Leipoldtia laxa* while woody shrubs include *Zygophyllum morgsana* and *Lycium ferocissimum* (Helme & Desmet, 2006).This area experiences high precipitation rates during winter while dry summer months are characteristic of the Succulent Karoo. The unit is classed as Least Concern with 95% of the unit remaining. Currently 5.8% of the unit is protected. The geological formations and vegetation may provide roosting and foraging sites, although only a small portion is located 5km from the site (**Figure 3**). This unit has a moderate potential of being utilised by bats for foraging and a high potential for providing roosting space (Table 1).

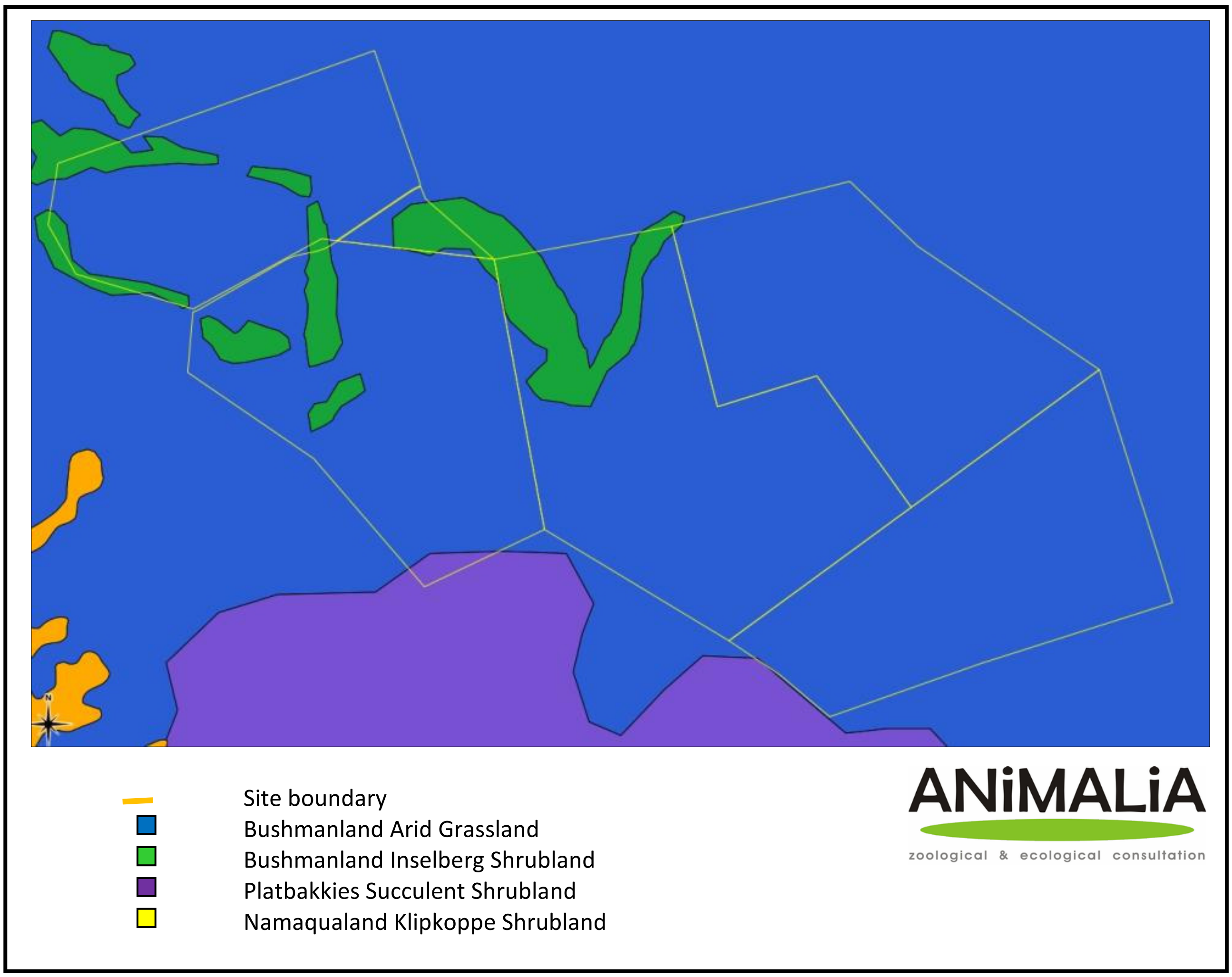


Figure 3: Vegetation units present on the Kangnas site (Mucina & Rutherford, 2006).

Table 1: The roosting and foraging potential of the vegetation units present on the Kangnas site.

(This table serves as an indicator of the likelihood of use of each vegetation unit by bats. The potential was graded based on observations and findings on site).

Vegetation Unit	Roosting Potential	Foraging Potential	Comments
Bushmanland Arid Grassland	Very Low	Low	Vegetation and geology mostly unsuitable for roosting and foraging, however man – made structures (buildings) and planted trees may provide roosting space. These structures are very limited on site.
Bushmanland Inselberg Shrubland	Moderate	Moderate	Rocky outcrops with crevices can offer roosting space for crevice dwelling species. The two small caves can offer some additional roosting space, or can be utilised as night roosts.
Platbakkies Succulent Shrubland	Low	Low	Vegetation unsuitable for foraging, geology and vegetation mostly not ideal for roosting.
Namaqualand Klipkoppe Shrubland	High	Moderate	Granite geology can provide suitable roosting spaces and offer sheltered foraging environments.

1.4 The bats of South Africa

Bats form part of the Order Chiroptera and are the second largest group of mammals after rodents.

Bats 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 maneuverability. This adaption surpasses the static design of the bird wings in function and enables bats to utilise a wide variety of food sources, including 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 numbers 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 their 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 limited knowledge of the ecological importance of bats. Some species also roost in domestic residences, causing disturbance and thereby decreasing any popularity bats may have. Other species may occur in large communities in buildings, posing as a potential health risk to the 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 is actually to the benefit of humans.

Many bat species roost in large communities and congregate in small areas. Therefore, any major disturbances within and around the roosting areas can adversely impact individuals of different communities within the same population concurrently (Hester and Grenier 2005). Secondly, natality (birth) 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 and so limit the amount of pups born due to this increased life expectancy. Under natural circumstances, a populations numbers can 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.

1.5 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 in Minnesota, USA, and, in this 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 wing sweep (Howe *et al*. 2002, Barclay *et al*. 2007) at night. In the United States of America this was thought to be due to the fact that migrating bats may navigate without the use of echolocation, rather using vision as its 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. A study conducted by Arnett (2005) recorded a total of 398 and 262 bat fatalities in two surveys at the Mountaineer Wind Energy Centre in Tucker County, West Virginia and at the Meyersdale Wind Energy Centre in Somerset County, Pennsylvania, respectively. These surveys took place during a 6 week study period from 31 July 2004 to 13 September 2004. In some studies, such as that taken in Kewaunee County (Howe *et al.* 2002) bat mortalities were found to be 3 times higher than bird mortalities in the area.

Although bats are predominately found in areas near trees, 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 subsequently 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 the turbine, thus attracting bats to the area. The presence of lights on wind turbines have also been identified as possible causes for increased bat fatalities. This is thought to be due to increased foraging activity of bats at lighted turbines, as a result of higher insect densities, opposed to non-lit turbines (Johnson *et al*. 2003). Clearings around wind turbines may also improve conditions for insects, thereby attracting bats to the area and the swishing sound of the turbine blades could confuse bats (Kunz *et al*. 2007). Electromagnetic fields generated by the turbine may also affect bats who are sensitive to magnetic fields (Kunz *et al*. 2007). It could also be hypothesized, that under natural circumstances, 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.

Whatever the reason for bat mortalities around wind turbines, the facts remain that this could be a very serious ecological problem when turbines are located in high risk habitat intensively utilised by bats. During a study by Arnett *et al*. (2009), 10 turbines monitored over a period of 3 months showed 124 bat fatalities in South-central Pennsylvania (America), which can cumulatively have a catastrophic long term effect on bat populations this rate of fatality continues. Most bat species only reproduce once a year, bearing one young per female, therefore their numbers are slow to recover from mass mortalities. It is very difficult to assess the true number of bat deaths as a result of the presence of wind turbines, due to the fact that many of the carcasses will be removed through predation, where the rate of removal differs as a function of habitat type (Howe *et al*. 2002, Johnson *et al*. 2003). Mitigation measures are being researched and experimented with globally.

The first option for effective and the most economical mitigation is the correct placement and layout of turbines on a site, avoiding high risk areas/habitats utilised by bats. The implementation of curtailment processes, where the turbine cut-in speed is raised to a higher wind speed, is a very aggressive and expensive mitigation measure only required if turbines are placed in sensitive areas where proof exists of high bat activity and numbers. Less aggressive curtailment processes entails the turbine blades to be stationary up to the manufacturer's recommended cut-in speed. This relies on the principle that the prey of bats will be less in areas of strong winds and more energy is required for the bats to fly under these conditions. It is thought, that by the implementation of such a measure, that bats in the area are not likely to be as impacted as when the turbine blades move slowly in low wind speeds.

2. ASSESSMENT 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 dependence of a bat on each of these factors depends on the species, its behaviour and ecology. Nevertheless if all three of these factors are common in an area the bat activity, abundance and diversity will also most likely be high.

Concerning species of bats that may be impacted by wind turbines, the Kangnas 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 (influences insects and acts as a source of drinking water). These comparisons were done chiefly by studying the geographic literature of each site, available satellite imagery and observations during the site visit. Species probability of occurrence based on the above mentioned factors were estimated for the site and the surrounding larger area.

The site was visited from the 18th to the 22th of July 2012. It was inspected during the day for any possible roosting and foraging sites. At dusk and during the night, the sky was monitored for visual observation of bats and bat activity.

The main method of bat detection involved the use of a bat detector to record bat echolocation calls on a continuous basis throughout most of the night while traversing the study area. Only sections of the farm that were accessible by vehicle were traversed. Refer to **Table 2** for sampling effort in terms of time and distance traversed with the bat detector and **Figure 4** for areas traversed.

A bat detector is a device capable of detecting and recording the ultrasonic echolocation calls of bats. These calls were then analyzed with the use of computer software. A time expansion type bat detector was utilised for the study, a time expansion detector effectively slows an ultrasonic bat call down 10 times such that bat calls become audible to the human ear, but still retain all of the harmonics and characteristics of the call. Although this type of bat detection equipment is advanced technology, it is not necessarily possible to identify all bat species by just their echolocation calls. Recordings of bat calls may be negatively affected by the weather conditions (i.e. high humidity) and openness of the terrain. The range of detecting a bat is also dependent on the volume of the bat call.

Positive bat calls were analysed for species identification and are represented spatially in **Figure8**.

Table 2: Details of bat detector transect sampling effort.

Date	Time spent traversing site	Distance covered (km)
18 July 2012	6 hrs 10 min	96.1
19 July 2012	4 hrs 41 min	69
20 July 2012	6 hrs 17 min	93.4
21 July 2012	6 hrs 45 min	123
22 July 2012	5 hrs 14 min	135

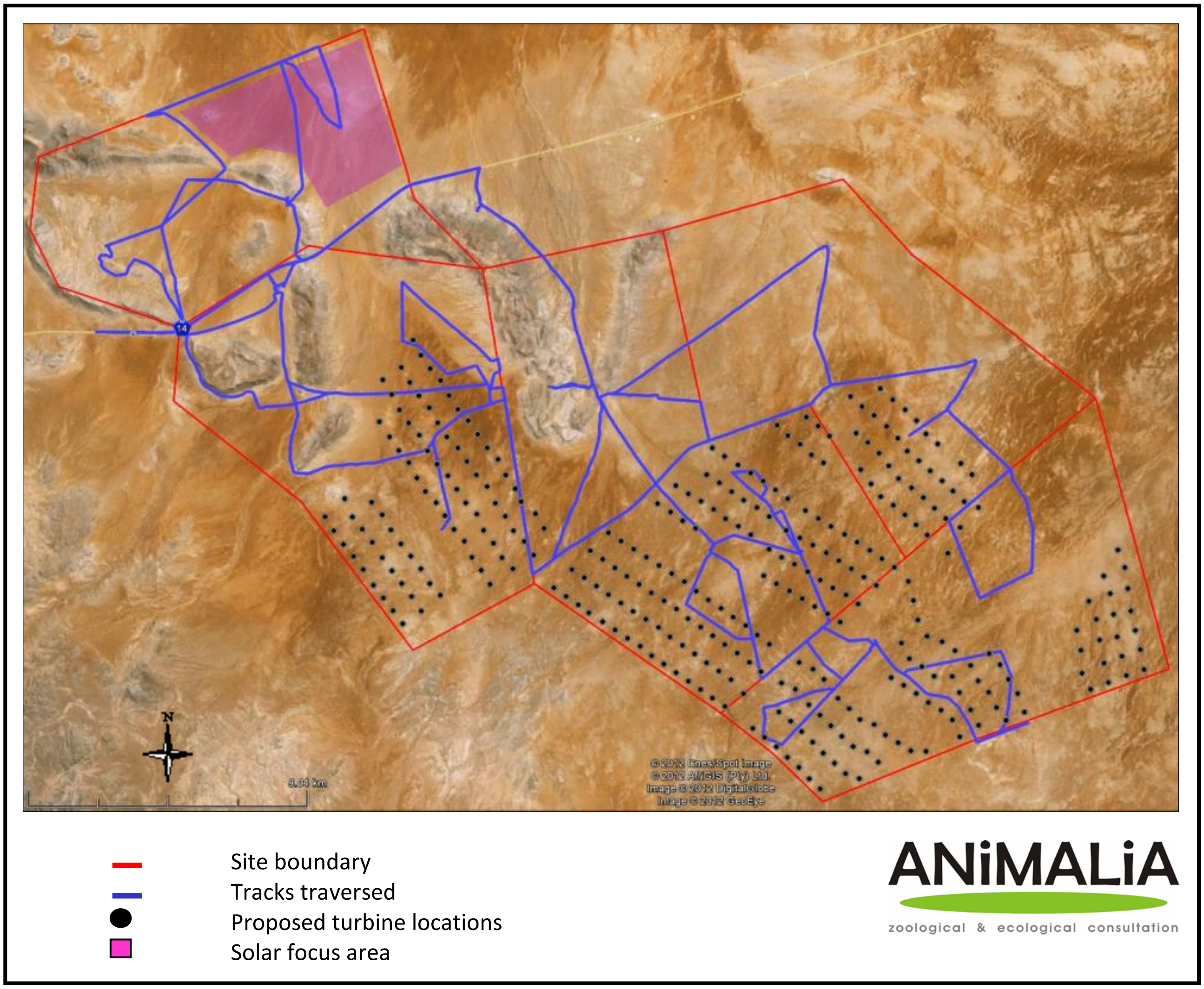


Figure 4: Extent of the site traversed for bat detection

2. 1 Assumptions and Limitations

Distribution maps of South African bat species still require further refinement such that the bat species proposed to occur on the site (that were not detected) are assumed accurate. If a species has a distribution marginal to the site it was assumed to occur in the area. The literature based table of species probability of occurrence 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 wind farm will have a large scale effect on migratory species. This limitation however will be overcome with a long-term sensitivity assessment.

The satellite imagery partly used to develop the sensitivity map may be slightly imprecise due to land changes occurring since the imagery was taken. Satellite imagery from Google Earth for 2012 was utilized to minimize this limitation.

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.

3. RESULTS

3.1 Species probability of occurrence

"Probability of Occurrence" is assigned based on consideration of the presence of roosting sites and foraging habitats on the site, compared to literature described preferences. The probability of occurrence is described by a percentage indicative of the expected numbers of individuals present on site and the frequency at which the site will be visited by the species. Bat species that were positively detected on the site are noted as Confirmed in the "Probability of Occurrence" column.

The column of "Likely risk of impact" describes the likelihood of risk of fatality from direct collision or barotrauma with wind turbine blades for each bat species. The risk was assigned by Sowler & Stoffberg (2012) based on species distributions, altitudes at which they fly and distances they travel.

Table 3: Table of species that may be roosting or foraging on the study area, the possible site specific roosts, and their probability of occurrence based on literature (Monadjem *et al.*, 2010).

Species	Common name	Probability of occurrence (%)	Conservation status	Possible roosting habitat to be utilized on study area	Foraging Habits (indicative of possible foraging sites in study area)	Likely Risk of Impact (Sowler & Stoffberg, 2012)
Rhinolophus clivosus	Geoffroy's horseshoe bat	20 - 30	Least Concern	Roosts in caves and rocky hollows, associated with arid savanna, woodland and riparian forest. The mountainous terrain in the area may provide rocky hollows, two small caves present.	Clutter forager, may possibly utilise sheltered rocky outcrop areas.	Low
Rhinolophus darlingi	Darling's horseshoe bat	20 - 30	Least Concern	Roosts in caves and mine adits associated with arid savannah. Mountainous characteristics of the area do provide small caves.	Clutter forager, may possibly utilise sheltered rocky outcrop areas.	Low
Nycteris thebaica	Egyptian slit-faced bat	40 - 50	Least Concern	Roosts in caves, aardvark burrows, road culverts, and trunks of large trees. It appears to occur throughout savannah and Karoo biomes.	Clutter forager, may possibly utilise sheltered rocky outcrop areas.	Low
Sauromys petrophilus	Roberts's flat-headed bat	70 - 80	Least Concern	Roost in narrow cracks and under slabs of exfoliating rock. Species is closely associated with rocky habitats in drywoodland, mountain fynbos and arid scrub.	Open air forager.	High

Tadarida aegyptiaca	Egyptian free-tailed bat	90 - 100 **Confirmed**	Least Concern	Roost in caves,rock crevices, under exfoliating rocks, in hollow trees, behind the bark of dead trees, and in roofs of houses.	Open air forager.	High
Miniopterus natalensis	Natal long-fingered bat	60 - 70	Near threatened	Cave-dependent. May use small caves on site for night stops. Current caves too small for day roosting, but possibility remains for larger unknown chambers.	Clutter-edge forager, may possibly forage along edges of rocky outcrops.	Medium - High
Cistugo seabrae	Angolan wing-gland bat	60 - 70	Near Threatened	It is restricted to the arid western parts of southern Africa, typically in desert and semi-desert conditions. Not a common bat.	Not well known, once netted at a dry stream bed in 2006 close to Vredesvallei.	Not known.
Eptesicus hottentotus	Long-tailed serotine	40 - 50	Least Concern	Roosts in caves and rock crevices, usually netted near rocky outcrops.	Clutter-edge forager, may possibly forage along edges of rocky outcrops.	Medium - High
Myotis tricolor	Temmink's myotis	50 - 60	Least Concern	Cave-dependent. May use small caves as day roost.	Clutter-edge forager, may possibly forage along edges of rocky outcrops.	Medium - High
Neoromicia capensis	Cape serotine	40 - 50	Least Concern	Roosts under bark of trees, at the base of aloe leaves and underthe roofs of houses.	Clutter-edge forager, may possibly forage along edges of rocky outcrops.	Medium - High

3.2 Surface rock, topography, climate, surface water and vegetation

Precipitation in the site area is very low, and channels or streams of any kind cannot be regarded as sustainable, such that surface water on this site is very limited. This reduces the sites' probability of use as a foraging area.

The site is found at a relatively high altitude with rocky outcrops in the north-west corner of the site (**Figure 5**). These will support bat roosts, the two small caves found (**Figure 6**) can offer some additional roosting space. Apart from the outcrops the terrain is relatively flat and featureless in the south eastern regions (**Figure 7**). The farm buildings can also provide suitable roosting spaces.

Figure 5: Typical rocky outcrops found in the north west of the site.

Figure 6: Small cave A (top) and small cave B (bottom).

Figure 7: The flat and relatively featureless terrain of the south eastern part of the site.

3.3 Bat detection

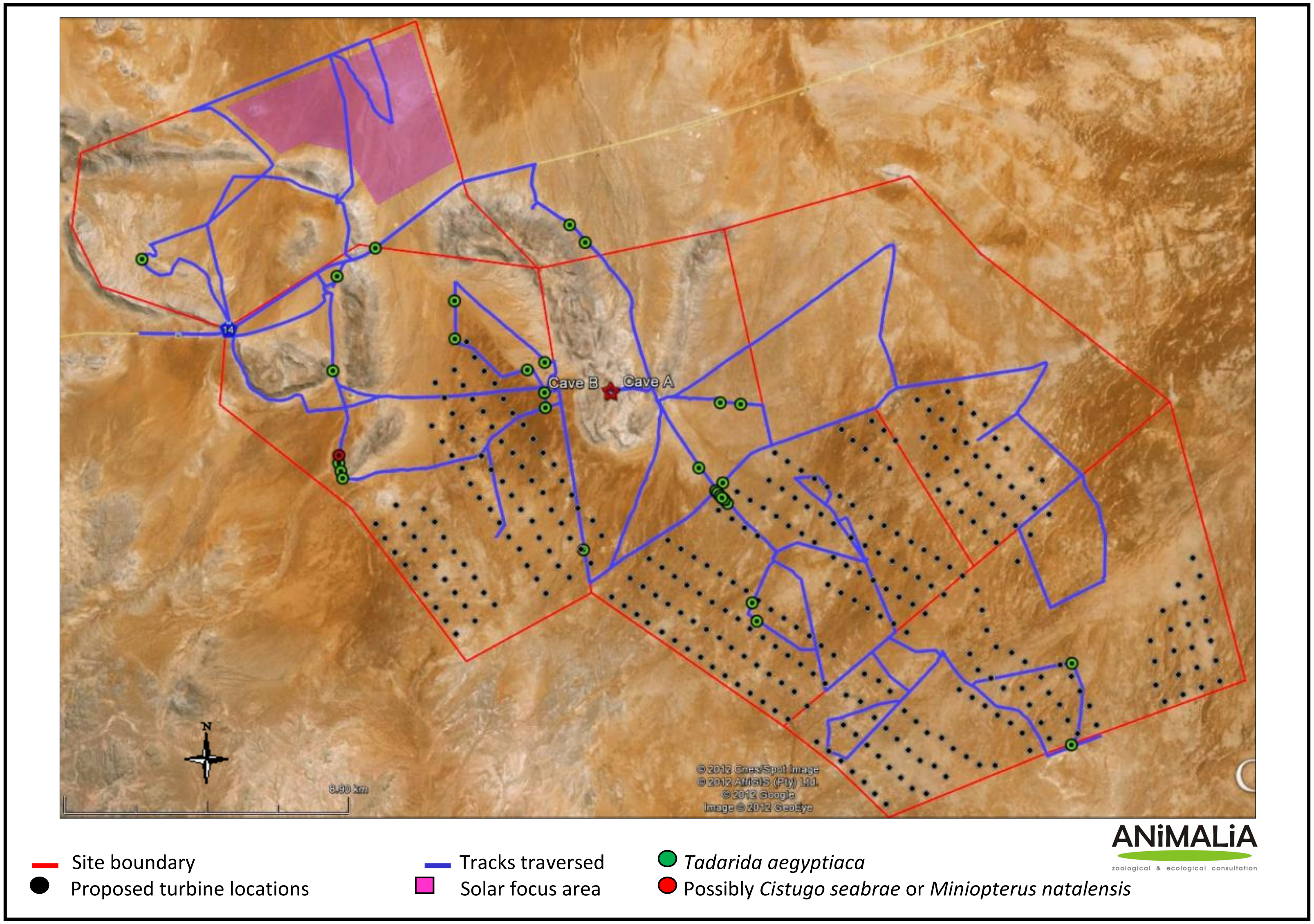


Figure 8: Spatial presentation of bats detected on site by means of transects.

3.4 Sensitivity map

These sensitivities are based on the findings of bat detection during the site visit and the probability of certain features and habitats to be utilised for roosting foraging purposes (see Table 1).

The High Bat Sensitivity areas are expected to have elevated levels of bat activity and possibly support greater bat diversity. High Bat Sensitivity areas are 'no – go' areas due to expected elevated rates of bat fatalities due to wind turbines. These areas were designated 500m radial buffer zones due to the open terrain and therefore larger expected foraging ranges.

Proposed turbines located within Moderate Bat Sensitivity areas and their respective buffer must receive special attention and preference with regards to bat monitoring and implementation of mitigations during the operational phase. These turbines within Moderate Bat Sensitivity areas and buffer zones must thus be prioritised for mitigation.

No proposed turbines are located within any High Bat sensitivity areas.

The possible *Cistugo seabrae* or *Miniopterus natalensis* call was one single bat call with a dominant frequency of approximately 49.4 and a short duration of 4.7ms, rendering it uncertain between the two species. Although *Cistugo seabrae* is endemic to South Africa it is considered to have a low threat from Wind Energy Facilities by Sowler & Stoffberg (2012) and was found within a high sensitivity area.

Table 4: Description of sensitivity categories utilized in the sensitivity map

Sensitivity	**Description**
Moderate Sensitivity	Areas of foraging habitat or roosting sites considered to have significant roles for bat ecology. Turbines within these areas must acquire priority for post-construction monitoring and mitigation measures.
High Sensitivity	Areas that are deemed critical for resident bat populations. These areas are 'no-go' areas and turbines or solar panels must not be placed in these areas.

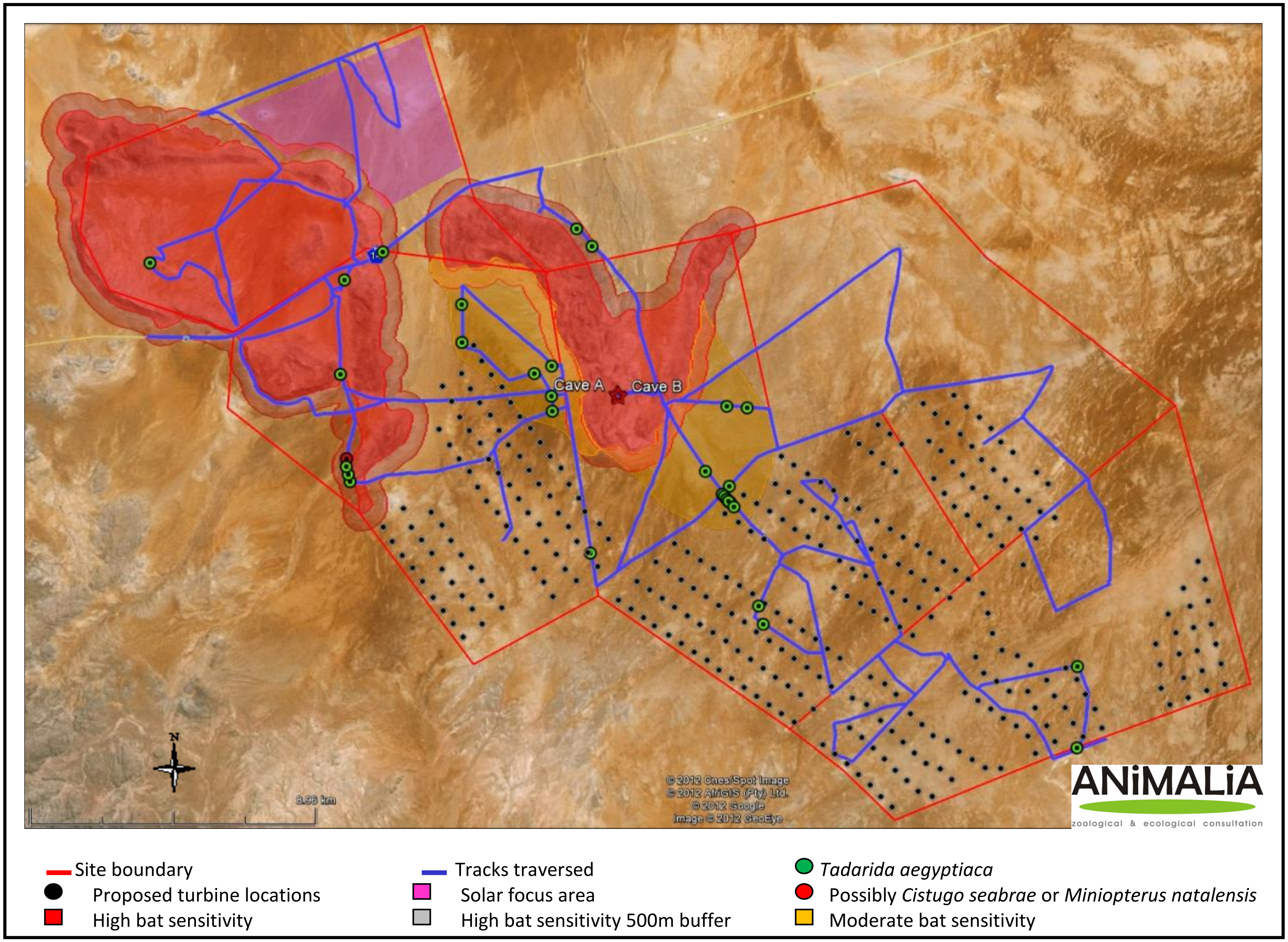
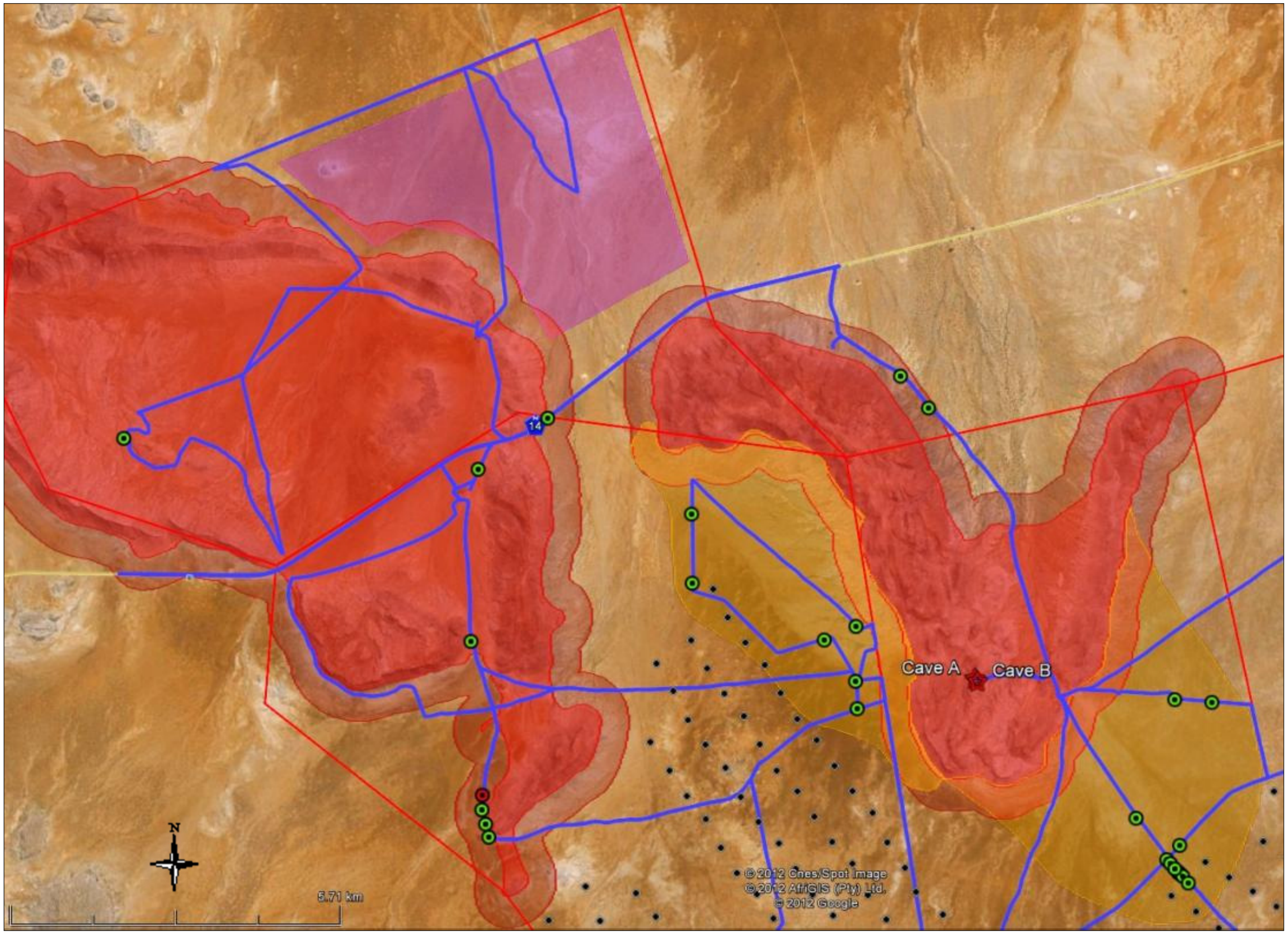


Figure 9: Bat sensitivity map.



Site boundary
Proposed turbine locations
High bat sensitivity
Tracks traversed
Solar focus area
High bat sensitivity 500m buffer
Tadarida aegyptiaca
Possibly *Cistugo seabrae* or *Miniopterus natalensis*
Moderate bat sensitivity

Figure 9: Bat sensitivity map of the north western part of the study site.

4. FORESEEN IMPACTS OF THE PROPOSED OPERATION and PROPOSED TERMS OF REFERENCE FOR ASSESSING/ADDRESSING THE ISSUES

4.1 Construction phase

4.1.1 Destruction of foraging habitat

Limited foraging habitat will be destroyed by the construction of the turbines and solar panels. This impact will be effective during the lifespan of the wind farm.

Proposed mitigation measures and recommendations

The placement of turbines or solar panels within areas identified as having a High Bat Sensitivity (**Figures 8 - 9**) should be avoided.

These areas must be avoided when the placement of associated infrastructure is considered. If possible, underground cabling should not be laid in these areas. If cabling is located within these areas, vegetation rehabilitation can be carried out to rectify this impact.

Significance Statement

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
Go ahead option										
Without mitigation	Long Term	3	Study Area	2	Moderate	2	May occur	2	**9**	**MODERATE -**
With mitigation	Long Term	3	Study Area	2	Slight	1	Unlikely	1	**7**	**LOW -**
No-go option										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**

4.2 Operational phase

4.2.1 Bat mortalities due to blade collisions and barotrauma during foraging

In section 1.5 the concern of bats and possible wind turbine blade collisions/barotrauma have been mentioned, but yet international research and experiments are unable to suggest sustainable large scale mitigation measures that can move this threat to a category of no concern.

Proposed mitigation measures and recommendations

The correct placement of wind farms and of individual turbines can significantly lessen the impacts on bat fauna in an area. Therefore areas designated as having a High Bat Sensitivity (**Figures 8 – 9**) must be avoided in turbine placement; additionally areas of Moderate Bat Sensitivity must receive special attention and be prioritised in post construction monitoring and implementation of mitigation measures.

Curtailment is an operational phase mitigation measure that can be implemented to lessen bat mortalities caused by direct collisions with turbine blades. Curtailment is the practice of maintaining the turbine blades stationary or 'locked' at low wind speeds, and once the wind exceeds a specified speed the blades are then allowed to rotate normally. The theory behind curtailment is that there exists a negative correlation between bat activity and wind speed, causing bat activity to decline as wind speed increases.

Baerwald *et al.* (2008) carried out a study wherein the wind speed trigger of 15 turbines, on an operational wind farm in south-western Alberta, was altered. Under normal circumstances the turbine blades turn slowly in low wind speeds, however they only begin to generate electricity when the wind speed reaches 4 m/s. During the experiment, the Vestas V80 type turbines were kept stationary during low wind speeds and only allowed to start turning and generating electricity at a cut-in speed of 5.5 m/s. During the peak bat fatality period, curtailment showed a reduction of bat fatalities by 60%.

Another strategy (used in the same experiment) involved altering blade angles to reduce rotor speed in low wind speed conditions, such that the blades were near motionless. This resulted in a significant 57.5% reduction in bat fatalities.

Long term field experiments and studies done by Arnett *et al.* (2010) in Somerset County, Pennsylvania, showed a 44 – 93% reduction in bat fatalities, with marginal annual power generation loss, when curtailment was implemented. Their study concluded that curtailment can be used as an effective mitigation measure to reduce bat fatalities at wind energy facilities. However, when using a cut-in speed of 6.5 m/s the annual power loss was 3 times higher than when implementing a 5.0 m/s cut-in speed.

It is important to note that the above mentioned experiments were applied only during peak bat activity periods, such as migratory seasons, which explains the resulting low annual energy production loss measured.

No such peak periods are predicted for this site, which would result in a higher annual energy production loss if curtailment is applied throughout most of the year. **Therefore correct placement of turbines are crucial and the recommended mitigation measure,.** which means that no turbines should be placed in areas of High bat sensitivity identified during the EIA phase as well as the pre-construction monitoring phase. The pre-construction monitoring would inform if any additional mitigation measures (e.g. acoustic bat deterrents) may be required on any other turbines, especially those located within areas of Moderate bat sensitivity.

A further mitigation measures involves the use of ultrasonic deterrent devices to repel bats from wind turbines. The device emits ultrasonic sound in a broad range that is inaudible to humans. This ultrasonic sound repels bats from wind turbines by creating a disorientating or irritating airspace around the turbine. Research in the field of ultrasonic deterrent devices is progressing and yielding some promising results, although controversy about the effectiveness and a lack of large scale experimental evidence exists.

Szewczak & Arnett (2008) performed a study involving the comparison of bat activity in the presence of an acoustic deterrent device and without the deterrent. The study showed that when ultrasound was broadcasted, only 2.5-10.4% of the control activity rate was observed. Other studies demonstrating the usefulness of the deterrent devices were carried out by Spanjer (2006) and Horn *et al.* (2008).

It may be feasible to install such devices on selected functional turbines within the Moderate Bat Sensitivity areas, with the results being monitored by an appropriately qualified researcher. Progression in the technology of such devices can possibly yield favourable results.

Pre-construction monitoring is recommended for at least four seasons at the proposed wind energy facility, focusing efforts on the Moderate bat sensitivity areas and the two small caves on site. Post-construction monitoring is optional for this site, and the need for it as well as the methodologies can be informed by the pre-construction assessment results. The results of these monitoring studies should inform mitigation measures, if any, should be implemented.

Significance Statement

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
Go ahead option										
Without mitigation	Long Term	3	Study Area	2	Moderate	2	Probable	3	**10**	**MODERATE -**
With mitigation	Long Term	3	Study Area	2	Slight	1	May Occur	2	**8**	**MODERATE -**
No-go option										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**

4.2.2 Bat mortalities due to blade collisions and barotrauma during migration

The migration paths of South African bats in the Cape Provinces are virtually unknown. Cave dwelling species like *Miniopterus natalensis* and *Myotis tricolor* undertake annual migrations, the caves on the Kangnas site can possibly provide roosting space for the above mentioned bat species. Although it is unlikely that these caves can support large migratory colonies, and no signs of bats were found in these caves.

Proposed mitigation measures and recommendations

It will be beneficial to collaborate with academic institutions to promote research on the subject, post construction monitoring, focusing on these caves, is recommended.

Significance Statement

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
Go ahead option										
Without mitigation	Long Term	3	Regional	3	Moderate	2	Unlikely	1	**9**	**MODERATE -**
With mitigation	Long Term	3	Regional	3	Slight	1	Unlikely	1	**8**	**MODERATE -**
No-go option										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**

4.3 Decommissioning phase

No impacts identified.

5. CONCLUSION

The Kangnas site does not display a high potential to support a high diversity or abundance of bats. Roosting space are moderately available, but the lack of open water sources and relatively low insect food abundance, does not allow for the support of large bat colonies.

No proposed turbines fall within a high bat sensitivity area or the associated buffer, proposed turbines within Moderate Bat Sensitivity areas should be prioritized in post-construction monitoring and implementation of possible mitigation measures that may possibly follow from post-construction monitoring.

Pre-construction monitoring is recommended for at least four seasons at the proposed wind energy facility, focusing efforts on the Moderate bat sensitivity areas and the two small caves on site. Post-construction monitoring is optional for this site, and the need for it as well as the methodologies can be informed by the pre-construction assessment results. The results of these monitoring studies should inform mitigation measures, if any, should be implemented

Possible mitigations that may follow post-construction monitoring may include a curtailment method which entails the blades to be stationary only at low wind speeds (below manufacturer's recommended cut in speed), and using the manufacturer's recommended cut in speed. This will be more economical and may be sufficient for this site.

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7. APPENDIX A

Animalia methodology for assessing the significance of impacts

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

1. Relationship of the impact to **temporal** scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
2. Relationship of the impact to **spatial** scales - the spatial scale defines the physical extent of the impact.
3. The severity of the impact- the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.
4. The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur, and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

Each criterion is ranked with scores assigned as presented in Table 1-1 to determine the overall **significance** of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in Table 1-2, to determine the overall significance of the impact (Table 1-3). The overall significance is either negative or positive.

The ***environmental significance*** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgement.

Negative impacts that are ranked as being of "**VERY HIGH**" and "**HIGH**" significance will be investigated further to determine how the impact can be minimised or what alternative activities or mitigation measures can be implemented. These impacts may also assist decision makers i.e. lots of **HIGH** negative impacts may bring about a negative decision.

For impacts identified as having a negative impact of "**MODERATE**" significance, it is standard practice to investigate alternate activities and/or mitigation measures. The most effective and practical mitigations measures will then be proposed.

For impacts ranked as "**LOW**" significance, no investigations or alternatives will be considered. Possible management measures will be investigated to ensure that the impacts remain of low significance.

Table 1-1: Criterion used to rate the significance of an impact

EFFECT	**Temporal scale**			**Score**
	Short term	Less than 5 years		**1**
	Medium term	Between 5 and 20 years		**2**
	Long term	Between 20 and 40 years (a generation) and from a human perspective almost permanent.		**3**
	Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there		**4**
	Spatial Scale			
	Localised	At localised scale and a few hectares in extent		**1**
	Study area	The proposed site and its immediate environs		**2**
	Regional	District and Provincial level		**3**
	National	Country		**3**
	International	Internationally		**4**
	Severity		**If Beneficial**	
	Slight / Slightly Beneficial	Slight impacts on the affected system(s) or party (ies)	Slightly beneficial to the affected system(s) or party (ies)	**1**
	Moderate / Moderately Beneficial	Moderate impacts on the affected system(s) or party(ies)	An impact of real benefit to the affected system(s) or party (ies)	**2**
	Severe / Beneficial	Severe impacts on the affected system(s) or party (ies)	A substantial benefit to the affected system(s) or party (ies)	**4**
	Very Severe / Very Beneficial	Very severe change to the affected system(s) or party(ies)	A very substantial benefit to the affected system(s) or party (ies)	**8**
LIKELIHOOD	**Likelihood**			
	Unlikely	The likelihood of these impacts occurring is slight		**1**
	May Occur	The likelihood of these impacts occurring is possible		**2**
	Probable	The likelihood of these impacts occurring is probable		**3**
	Definite	The likelihood is that this impact will definitely occur		**4**

Table 1-2: The matrix that will be used for determining SIGNIFICANCE by using the EFFECT and the LIKELIHOOD of occurrence; EFFECT is the sum of the spatial, temporal and severity factors.

		Effect													
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Likelihood	**1**	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	2	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	3	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	4	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Table 1-3: The significance rating scale

Significance	Description	Positive Score	Negative Score
Low	An acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment.	**4-7**	**4-7**
Moderate	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.	**8-11**	**8-11**
High	A serious impact, if not mitigated, may prevent the implementation of the project (if it is a negative impact). These impacts would be considered by society as constituting a major and usually a long-term change to the (natural &/or social) environment and result in severe effects or beneficial effects.	**12-15**	**12-15**
Very High	A very serious impact which, if negative, may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are unmitigable and usually result in very severe effects, or very beneficial effects.	**16-20**	**16-20**

8. APPENDIX B - Specialist declaration of interest

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed wind and solar (photovoltaic) energy facilities near Springbok, Northern Cape

Specialist:	Werner Marais		
Contact person:	Werner Marais		
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Project Consultant:	Aurecon South Africa (Pty) Ltd		
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4.2 The specialist appointed in terms of the Regulations_

I, Werner Marais, declare that

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company (if applicable):
Animalia Zoological & Ecological Consultation CC

Date: 31 August 2012

Compiled by:

Werner Marais

Zoologist and Ecologist
MSc (Biodiversity & Conservation, UJ)
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