Proposed Humansrus Solar Thermal Energy Power Plant

SPECIALIST AVIFAUNAL IMPACT ASSESMENT

EIA REPORT
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Declaration of Independence

All specialist investigators specified above declare that:

- We act as independent specialists for this project.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- The specialist investigator, and the Endangered Wildlife Trust, for whom he/she works, does not accept any responsibility for the conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from these assessments or requests made to them for the purposes of this assessment.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator withholds the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
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- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 21st September 2011 by Andrew Pearson in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.

Executive Summary

Solar Reserve SA (Pty) Ltd is planning a 100 MW Solar Thermal Energy Power Plant (or otherwise known as a Concentrated Solar Power (CSP) plant) on the Farm 469, Hay RD (Humansrus), approximately 30 km east of Postmasburg, in the Northern Cape. Very few CSP plants have been constructed worldwide to date, and knowledge on the associated avifaunal impacts remains limited. Therefore, the level of confidence with which the various impacts are discussed and predicted is therefore relatively low.

The site consist mainly of uniform, arid vegetation types sites. Few permanent water bodies are on site. The proposed site falls within the Quarter Degree Grid Square (QDGS), 2823AD, and the South African Bird Atlas Project (SABAP) records 168 bird species of which 11 are Red Listed Species. Various other species relevant to the project were identified and include raptors, doves, pigeons and aerial foragers such as swallows and swifts.

Potential impacts of the project on avifauna were found to be of two types; those related to the CSP itself, and those relating to additional infrastructure. The former includes collision of birds with heliostats, burning of birds in focal points, collision with the central receiver tower, burning in the vicinity of the receiver tower as well as and habitat destruction and disturbance of birds. With regards to additional infrastructure, associated powerlines may result in electrocution and collision impacts on avifauna, while the development of various infrastructures will also cause habitat destruction and disturbance. The majority of all impacts discussed above, are likely to be of medium significance. The presence of open water ponds close to the CSP plant could drastically increase the potential for avifaunal impacts, especially when one considers the proximity of the site to already established water bird populations at the three CWAC sites.

It is unlikely that effective mitigation of impacts associated with the burning of birds as well as collision with heliostats, will be possible, but this will need to be confirmed once the plant is operational and some experience is gained. For this reason it has been recommended that a monitoring protocol, for the operational phase of the project, be incorporated in to the project EMP. This will insure that any bird mortalities are recorded and reported. The impacts of disturbance and habitat destruction can be mitigated by ensuring that the construction Environmental Management Plan incorporates guidelines as to how best to minimize this impact. Mitigation of collision with overhead powerlines will involve marking the relevant sections of line with appropriate marking devices.

Introduction

Solar Reserve SA (Pty) Ltd is planning a Solar Thermal Energy Power Plant (or otherwise known as a Concentrated Solar Power (CSP) plant). SSI was appointed as independent environmental consultants to conduct the Environmental Impact Assessment (EIA) process for the proposed development, and the Endangered Wildlife Trust (EWT) was subsequently appointed to conduct an avifaunal specialist study. Following the completion of the Scoping phase of the project, Worley Parsons RSA, took over as the independent Environmental Consultants, while the EWT was retained for the completion of the EIA phase. The proposed CSP plant is located on the Farm 469, Hay RD (Humansrus), approximately 4 km southeast of Groenwater and 30 km east of Postmasburg, in the Northern Cape (see Fig. 1). Solar Reserve is assessing the feasibility of constructing a CSP plant with a maximum capacity of 100 MW which will require an area of approximately 800 ha. To the authors knowledge only two plants have been constructed to date, i.e. Solar One - an experimental 10 MW plant built in 1979 in Barstow, California and Solar Two – an improvement on Solar One at the same site. A 40 MW plant is also under development in Spain (Spain Solar Tres).

The proposed site falls within the Quarter Degree Grid Square (QDGS), 2823AD, and the South African Bird Atlas Project (SABAP) records 168 bird species of which 11 are Red Listed Species (Harrison *et al*, 1997). In addition, three Coordinated Waterbird Count (CWAC) areas, which are regarded as sites important for water birds either by virtue of the species present or the numbers in which they are represented, are within close proximity to the study area.

Figure 1: Google Earth image showing the relative position of the proposed CSP plant at Humansrus, depicted on the map with by the yellow star, as well as Postmasburg to the West and Kimberley to the South East.

Terms of Reference

The following terms of reference for the EWT avifaunal study were adopted:

- **Identification of sensitive sites:** The bird sensitive sections of the study area will be identified.
- **Describe affected environment and determine status quo:** The existing environment will be described and the bird communities most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.
- **Describe focal species:** Threatened bird species (as per red data book status), will be identified, and species most likely to be impacted upon will be identified.
- **Identification of impacts:** The potential impact on the birds will be identified.
- **Assess and rate the identified impacts.** The significance of the potential impacts will be rated according to a set of pre-determined criteria.
- **Assess alternatives.** A comparative assessment of the avifaunal impacts related to proposed project alternatives.
- **Propose and explain mitigation measures:** Practical mitigation measures will be recommended and discussed.

Methodology

The following section describes the process and criteria used to assess the site during the in terms of avifaunal impact.

- The study was initially conducted from a desk top level. Using various GIS layers, 1:50 000 topographical maps and Google earth images, key features within the study area were identified and a map of the site and surrounding area was created using ARCGIS 9.3.
- The various data sets discussed below under "sources of information" were collected.
- This data was examined to determine presence of sensitive Red Data species in the study area.
- Abundance of the species most sensitive to this project (not necessarily red listed species) was determined.
- A thorough site visit was conducted.
- Bird micro-habitats were then identified and described.
- Proximity of the site to water was assessed, as was the presence of small water features (e.g. dams or water troughs) within the site boundary.
- The impacts of the proposed project on birds were then predicted.
- Impact were assessed using a standard set of criteria (see Appendix A), as supplied by SSI environmental consultants.

Sources of Information

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison et al, 1997) obtained from the Avian Demography Unit (ADU) of the University of Cape Town, as a means to ascertain which species occur within the study area. A data set was obtained for these quarter degree square (Table 1).
- The SABAP 2 data for the relevant Pentads was also consulted.
- Data from the Co-ordinated Avifaunal Road count project (CAR – Young, Harrison, Navarro, Anderson & Colahan, 1997) for the "Mpumalanga Precinct".
- Data from the Co-ordinated Waterbird Count (CWAC) project was also consulted to determine whether any CWAC sites exist in the study area (Taylor, Navarro, Wren- Sargent, Harrison & Kieswetter, 1999).
- The Important Bird Areas of southern Africa (IBA) project data (Barnes 1998) was consulted to determine its relevance to this project.

- The conservation status of all bird species occurring in the aforementioned quarter degree square was determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- Electronic 1:50 000 maps were obtained from the Surveyor General.
- High resolution satellite imagery from Google Earth was used to aid in the identification of micro-habitats

Scope, Limitations and Assumptions

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

- In assessing the impacts of the associated infrastructure such as a new power line – the EWT is hugely experienced. However, with regard to the impacts of the CSP plant itself, this is largely new territory – quite possibly the case for all consultants on this project. With the exception of the one paper already cited, very little information on avifaunal impacts at existing solar plants could be found**. The level of confidence with which the various impacts are discussed is therefore relatively low**. However it must also be stated that many of the impacts of the CSP plant itself cannot readily be mitigated for in any case. For example if birds mistake the heliostats for water sources and are burnt in the focal points, mitigation for this would be very difficult.
- Unfortunately the Southern African Bird Atlas Project (Harrison et al 1997) data is now relatively outdated. This results in a low confidence in the report rates of the various species in the study area. Furthermore, updated data for the second bird atlas project (SABAP2), revealed a low number of counts for the relevant pentad.
- The site visit was conducted in May, over which time various species may not have been present in the study area.
- The SABAP data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate.
- The final and exact position and nature of the associated infrastructure such as pipelines, power lines and roads was not available during the site visit.
- **Associated overhead powerlines, extending out of the site boundary, to connect with the Eskom Grid, may have large impacts; these however will fall within a separate EIA process, and were not assessed in this study.**
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behavior can never be entirely reduced to formulas that will hold true under all circumstances.

Review of potential avifaunal issues

Extensive review of the available literature on the internet relating to avifaunal interactions at solar energy power plants revealed very little, particularly in comparison to the literature available on avifaunal interactions with other forms of power generation. Possible reasons for this include the following:

- Little knowledge on these impacts exists since so few solar plants have been constructed to date.
- The two plants previously constructed were experimental sites, not commercial. All information related to the experiments would therefore have been private and not released into the public domain.
- The impacts of solar power plants of this type on avifauna are in fact relatively minor.

One paper entitled "Avian mortality at a solar energy power plant" (McCrary, McKernan, Schreiber, Wagner & Sciarrotta 1986) was discovered. This paper describes the results of their weekly monitoring over a two year period at Solar One. The main results of this study are summarized below:

- Forty visits (one week apart) to the facility over a two year period revealed 70 bird carcasses involving 26 species. It was estimated that between 10 and 30% of carcasses were removed by scavengers in between visits, so the actual number of mortalities may have been slightly higher. It is important to note that extensive agricultural lands and evaporation ponds (53 ha) were situated adjacent to the facility, which probably resulted in a higher abundance of many bird species than would otherwise have been the case.
- Fifty seven (81%) of the birds died through collision with infrastructure, mostly (>75%) colliding with the heliostats. Species killed in this manner included water birds, small raptors, gulls, doves, sparrows and warblers.
- Thirteen (19%) of the birds died through burning in the standby points. Species killed in this manner were mostly swallows and swifts.

Briefly, some of the anticipated avifaunal issues involved with the Humansrus Solar Thermal Energy project are now described below.

Issues relating to the CSP plant itself:

- Collision with the heliostats (mirrors):
  Reflective surfaces are particularly prone to collisions in the same way as household windows. The CSP plant will consist of hundreds or thousands of heliostat mirrors and can be expected to result in some collisions.
- Collision with the central receiver tower:
  Almost any infrastructure that stands proud in the landscape will result in a certain number of collisions by birds. In this case, the central receiver tower will stand approximately 200 m tall, a significant height, particularly in this landscape. A mitigating factor is that it will be a solid concrete tower and should be relatively visible to birds.
- Roosting on the central receiver tower:
  Birds could potentially use the top of the tower as a roosting site at night. It is likely that they would only come in to roost after the plant has been shut down in the evenings, and would leave the roost before the plant starts up in the morning.
- Burning when in vicinity of the central receiver:
  The central receiver will glow white hot when the plant is operational which might potentially result in birds in the vicinity being burnt.
- Burning when entering the "standby focal points":
  During testing, maintenance and daily start up procedures, the heliostats are focused in groups onto focal or standby points in the sky, usually at roughly the same height as the central receiver (approximately 200 m). In the case of the CSP plant, there will be numerous standby points. McCrary et al found that 19% of the birds that were found dead at Solar One were burned in standby points. Avian foragers such as swifts and swallows accounted for 46% of these mortalities. The more time a bird spends in the air the more chance there is of it flying into a standby point. The height at which species fly is also critical, species likely to fly at this height include the swifts, swallows, and martins.
- Loss of habitat:
  The CSP plant will take up an area of approximately 3 km squared. This would obviously be habitat previously available to the birds in the area.
- Disturbance:
  Resident bird species may be disturbed by construction, operational and maintenance activities associated with the CSP plant, particularly whilst breeding.
- Nesting of Sociable Weavers and other species on the plant infrastructure:
  Experience in this arid region has shown that Sociable Weavers are quick to nest on any manmade infrastructure and they may utilize infrastructure at the CSP site.

It is important to stress that most of the above impacts – and certainly the first five listed impacts – will probably only become significant when large numbers of birds are in the vicinity of the CSP plant. For example one swallow being burnt in a focal point would hardly be considered a significant impact. However, if a large flock of swallows congregated – perhaps due to a nearby roost site – a large number of birds could be burnt and the significance would be greatly amplified. For this reason, the more sensitive species in terms of the above impacts are likely to be the gregarious, flocking species.

Issues relating to the associated infrastructure:

The EWT believes that the impacts of the associated infrastructure such as overhead power lines on birds may in fact outweigh the impacts of the CSP plant itself, depending on the length of new infrastructure that needs to be constructed. The proximity of site to the existing power line and road infrastructure is therefore very important. The closer the final site is to existing infrastructure, the less new infrastructure will need to be built. Briefly, the impacts of the associated infrastructure are as follows:

<u>New power line:</u>

- Collision with associated power line infrastructure.
- Electrocution on associated power line infrastructure.
- Nesting on associated power line infrastructure.
- Disturbance through construction and maintenance activities of new power line.
- Habitat destruction through construction activities of new line.

<u>New road/s:</u>

- Disturbance of avifauna through construction and maintenance activities.
- Habitat destruction through construction activities.

<u>New pipe line/s:</u>

- Disturbance of avifauna through construction and maintenance activities.
- Habitat destruction through construction activities.

Issues or factors that may attract birds to the vicinity of the CSP plant thereby amplifying the above interactions/impacts:

In this arid, relatively uniform landscape, large congregations of birds are unlikely unless a strong attractant exists, such as water.

- Birds attracted to open water evaporation ponds:

  In this landscape, any source of water is hugely important for all animals - including birds. If the CSP plant involves any open water sources such as evaporation ponds, this will attract more birds into the immediate area thus heightening the risk of the above impacts occurring. McCrary *et al* (1986) found a number of water birds (teal, grebes, coots) that had collided with heliostats at Solar One and this is almost certainly related to the presence of large (53 ha) evaporation ponds nearby. This is supported by the fact that 45% of all species recorded in 150 ha around Solar One, were only recorded at the ponds. The importance of the evaporation ponds at Solar One to birds is further illustrated by the fact that 107 bird species were recorded in the vicinity of Solar One, whilst the avian community in similar habitat elsewhere is usually less than 20 species. It is clear then that the presence of open water ponds close to the CSP plant would drastically increase the potential for avifaunal impacts.

- Birds mistakenly attracted to heliostats:

  In these arid regions the daily activity schedule of many animals and birds revolves around securing their required daily intake of water. For example, Namaqua Sandgrouse (medium report rate in the study area) fly in flocks to water sources during mid to late morning. There is a possibility that birds such as these may mistake the heliostats for water sources when flying high above and descend to investigate. In the case of the Sandgrouse, they would typically circle several times once they have located a water source, before descending. If the heliostats are mistaken for water, these birds would most likely circle through one or more focal points and may well be burnt to death.

Regional Overview

The Northern Cape region is one of the most arid in southern Africa. In examining the region as a whole in terms of avifauna, it is important to relate the avifauna to the biomes and vegetation types present in the area. Harrison *et al* (1997) in "The Atlas of Southern African Birds" provide an excellent description of the various biomes represented in the region and the associated bird species. It is widely accepted within the ornithological community that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et al* 1997). Therefore, this vegetation description focuses on factors which are relevant to bird distribution and is not a complete account of plant species. Of more relevance is the description of micro-habitat, given in following sections of this report

Nama karoo biome: This biome comprises mainly low shrubs and grasses, trees such as *Acacia karoo* and exotic species such as *Prosopis glandulosa* are restricted to watercourses. Compared to "succulent karoo", "nama karoo" has a much higher proportion of grass and tree cover. The "karoo" used loosely to mean both "nama" and "succulent karoo", supports a particularly high diversity of species endemic to southern Africa. Avifauna characteristically comprises ground dwelling species of open habitats. The tree lined watercourses allow penetration of several species typical of arid woodland such as the Kori Bustard and Karoo Korhaan. Several species are almost entirely confined to the "Nama karoo" such as the Red Lark and Sclaters Lark. Because rainfall in the "nama karoo" is in summer and the neighboring "succulent karoo" has winter rainfall, there is opportunity for species to migrate seasonally between the two. Two species suspected to do so (on the basis of atlas data) are the Ludwig's Bustard and Larklike Bunting.

Woodland biome: Woodland covers much of the northern and eastern parts of the country and is defined as having a distinct grassy under story and a woody upper story of trees and shrubs. Tree cover can range from sparse such as in the southern Kalahari, to almost closed. The more arid woodland types such as the Kalahari vegetation types are typically fine leaved and dominated by acacias and typically occur on nutrient rich, often alluvial soils in the western regions.

Central Kalahari is characterized by sparse to dense shrubland on deep Kalahari soils, grass cover is variable and dependant on rainfall. Southern Kalahari consists of open shrubland on deep Kalahari sands and again, grass cover is variable and dependant on rainfall. Avifauna of the Kalahari vegetation types is characteristic, with many species that occur in the moister woodlands avoiding the Kalahari, probably due to the absence of surface water. At the same time there are no species truly endemic to the Kalahari, most of them also spread to other woodland types. Two

species which have their ranges centered on the Kalahari however, are the Fawn-colored Lark and Kalahari Robin, representing possibly the closest to endemic species of the Kalahari.

A more site specific vegetation descriptions can be obtained from Mucina & Rutherford 2006, and the vegetation types occurring on site are identified in Figure 2 below. Six vegetation types are present in the surrounding areas of the site, namely Ghaap Plateau Vaalbosveld, Kuruman Mountain Bushveld, Kuruman Thornveld, Olifantshoek Plains Thornveld, Southern Kalahari Mekgacha, and Southern Kalahari Salt Pans. Two vegetation types Olifantshoek Plains Thornveld and Kuruman Mountain Bushveld are present within the site itself, with the former representing the majority of the area.

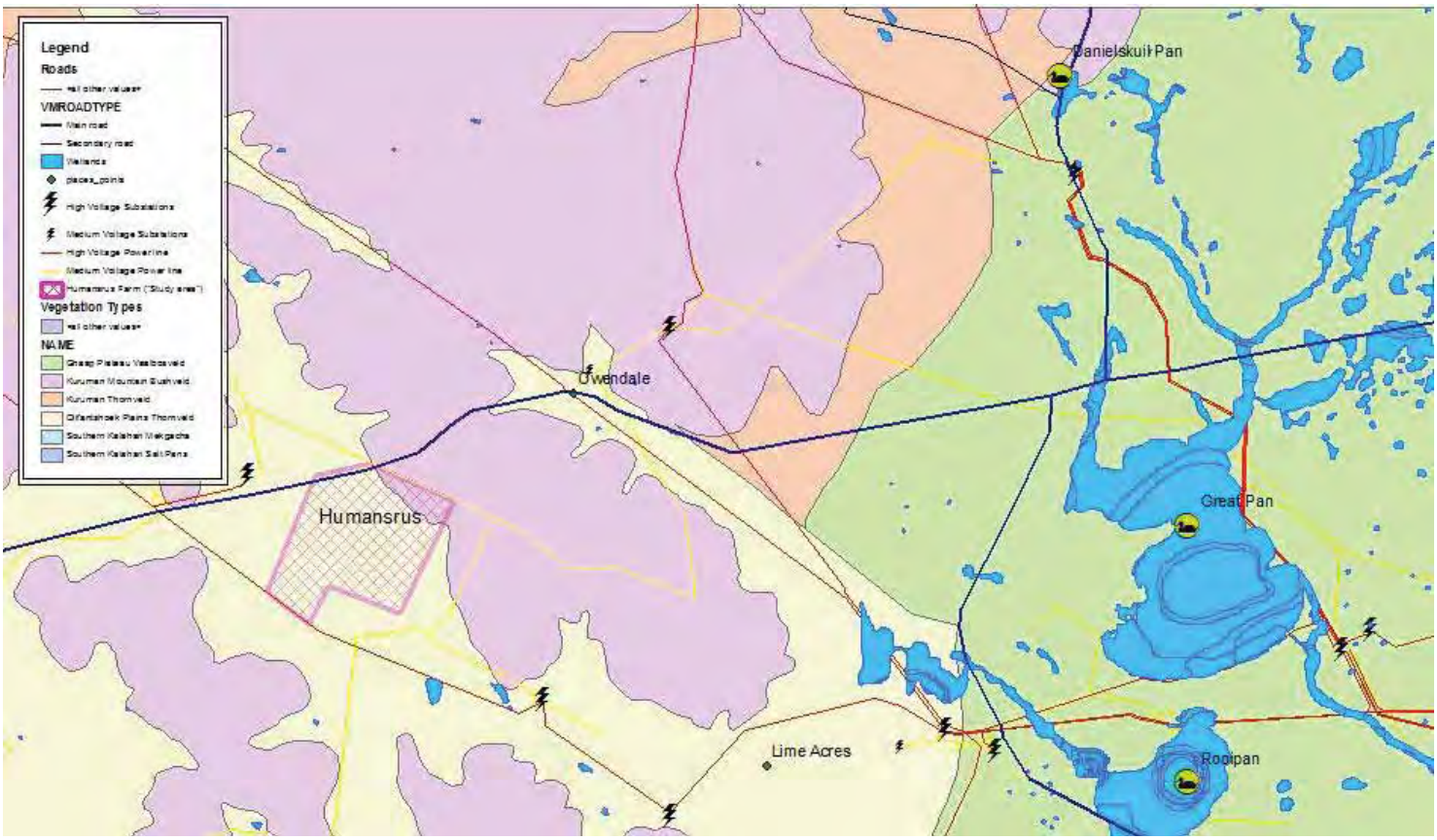

Figure 2: Vegetation Map of the site and surrounding areas, also showing CWAC sites, existing power lines, substations, roads, wetlands and places of human settlement.

Presence of Red Data bird species

Table 1 below shows report rates for the Red Data species in the study area (Harrison *et al* 1997). Report rates are an expression of the number of times a species is counted in a particular square expressed as a percentage of the number of times that square was counted. A total of 168 species have been recorded for the QDGS, which had been relatively well counted with 77 cards submitted. Eleven species recorded are listed in the red data book (Barnes, 2000)

Table 1: Red Data species recorded in the quarter degree square (2823AD) covering the study area (Harrison *et al* 1997).

Total species	168
# cards submitted	77

Species	**Cons. status**	**Report Rate (%)**
Tawny Eagle	VU	1
Martial Eagle	VU	6
Lesser Kestrel	VU	13
Blue Crane	VU	6
Kori Bustard	VU	1
White-backed Vulture	VU	17
Black Harrier	NT	1
Black Stork	NT	5
Secretarybird	NT	9
Greater Painted-snipe	NT	1
Greater Flamingo	NT	5

CE = Critically endangered, E = Endangered, VU = Vulnerable, NT = Near threatened.

An evaluation of CAR data revealed that there were no Co-ordinated Avifaunal Road-count routes through or near to the site. The site does not fall within an Important Bird Area (IBA) and there were no IBA's within close proximity to the site.

An evaluation of the SABAP 2 data revealed that of the four pentads in the study area, pentad number 2820_2325, was the only one that had been sufficiently counted. This is likely due to the

fact that the settlement of Lime Acres falls within this pentad. The data for this pentad did not reveal any additional information to that obtained from the SABAP 1 data.

Three CWAC sites were identified to the east of the study area, namely Danielskuil Pan, Great Pan, and Rooipan, and are shown in Figure 2.

Danielskuil Pan actually consists of two dams and a dam/pan with open shoreline, some shorebird habitat, and almost no fringing vegetation. Formerly, the dam/pan received water from local sewage works. Counts are available for 1996 and 1997, when mainly small numbers of 17 species were recorded, 16 species in summer (only South African Shelduck being missing) and only 3 in winter (SA Shelduck, Threebanded Plover and Cape Wagtail). The most numerous birds in summer were Whitefaced Duck, Blacksmith Plover (a good count of 47 birds in 1997), Curlew Sandpiper and Little Stint. Pollution by sewage and domestic refuse is an important threat; mild threats are fishing, and overhead powerlines. Data was not available for Great Pan, and neither for Rooipan, as both sites are classed as private, and individual cards are not available for public viewing. The species occurring at these sites are expected to be similar to those present at Danielskuil Pan, discussed above.

Bird Micro-habitats

An examination of the micro habitats available to birds within the study site was conducted. These are generally evident at a much smaller spatial scale than vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man-made infrastructure. The following micro-habitats were identified on site:

Drainage Lines and Wetlands

Figure 3: An example of a drainage line, with evidence of erosion, observed in the general study area.

Few wetland areas were observed on site. There is a "vlei" area situated parallel to the rail line at the south west of the site which appears to flow toward a small dam (see section below). The desktop study revealed the presence of Salt Pans and CWAC sites in the surrounding area (discussed above). Drainage lines and wetlands are an important form of habitat to numerous species. Drainage lines are often surrounded by natural grasslands, which may provide habitat for species such korhaans, cranes, larks and pipits. Various waterfowl, such as ducks and geese, may make use of these areas

Man-made Dams

Figure 4: A small dam observed, close to the western boundary of the farm.

Artificially constructed dams have become important attractants to various bird species in the South African landscape. Various waterfowl frequent these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas. Therefore dams are a key element of this study, and should be classed as no-go areas for this project.

Grassland

Figure 5: Grassland observed on site

Grassy areas make up the majority of the site and fall within the areas classified as Olifantshoek Plains Thornveld. Grasslands represent a significant feeding area for many bird species such as Blue Crane, Secretarybird, Kori Bustard and Northern Black Korhaan. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as small mammals such as Suricates (see Fig. 6). This in turn may attract large raptors because of both the presence and accessibility of prey.

Figure 6: A group of Suricates observed at their burrows, in grassland, near to the site.

Bushveld, Woodland and Thicket patches

Figure: 7: A woodland and Thicket patch observed on site

Small patches of Acacia thickets and bushes were observed, usually close to disturbed areas such as homesteads and kraals. As one moves to the periphery of the site, away from the flat grassy areas, the elevation rises and small trees and bushveld appear (depicted as "Kuruman Mountain

Bushveld" discussed above). These areas attract smaller passerine species such as Robins and Shrikes. Weavers and Sparrow-weavers use the tree as structures for nesting and Raptors such the Southern Pale Chanting Goshawk may use these areas for perching.

Figure 8: A photograph taken from an elevated point, east of the site, looking west towards the site, showing grassy areas of Olifantshoek Plains Thornveld at lower elevation, and Kuruman Mountain Bushveld at a higher elevation. The majority of the site is to be built in the flat lower lying area.

Water-trough points

Figure 9: A central water point for cattle on site. Note the short grazed grassy areas.

Through overgrazing and the clearance of vegetation by cattle at these feeding and watering points, a microhabitat favoured by certain species has been created. Small species such as robins and wagtails are attracted to the water trough itself to drink, while the open, short grassy areas are favoured by terrestrial species such as coursers and lapwings. Francolins and korhaans were also observed foraging in these areas during the site visit

Table 2 below shows the micro habitats that each Red Data bird typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis below represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant.

Table 2: Preferred Micro-habitats and likelihood of occurrence on site of Red Data species recorded in the relevant QDGS.

Species	**Preferred Micro-habitat**	**Likelihood of occurrence on site**
Tawny Eagle	Woodland and Bushveld	Unlikely
Martial Eagle	Woodland, savannah and Shrublands	Possible
Lesser Kestrel	Arable lands and Grasslands	Likely
Blue Crane	Farm Dams, cultivated lands and grassland	Likely
Kori Bustard	Grasslands and Bushveld	Unlikely
White-backed Vulture	Savannah Woodlands and Bushveld	Possible
Black Harrier	Cultivated lands and Grasslands	Unlikely
Black Stork	Rivers and Kloofs	Unlikely
Secretarybird	Cultivated lands and Grasslands	Possible
Greater Painted-snipe	Dams and Wetlands	Unlikely
Greater Flamingo	Dams and wetlands	Possible

Focal species

After determining the red data species that are likely or may possibly be found on site, as well as identifying the microhabitats, the focal species for the study were identified. Table 3 below shows the report rates for selected species that have been recorded in the quarter degree squares covering the study area (Harrison *et al* 1997). Focal Red Data species have been included, as well as a selection of non Red Data species which are considered to have particular relevance to this study such as raptors, doves, pigeons and aerial foragers such as swallows and swifts. Those species observed during the site visit are also indicated.

Table 3: Report rates for selected Focal Red Data species and a selection of other species that are considered particularly relevant to the study (Harrison *et al* 1997)

Species	**Cons Status**	**Report Rate (2823AD)**
Martial Eagle	VU	6
Lesser Kestrel	VU	13
Blue Crane	VU	6
White-backed Vulture	VU	17
Secretarybird	NT	9
Greater Flamingo	NT	5
Grey Heron*		56
Cape Teal		57
Verreaux's Eagle		55
Booted Eagle		4
Black-shouldered Kite*		69
Jackal Buzzard		0
Pale Chanting Goshawk		39
Rock Kestrel		79
Greater Kestrel		12
Helmeted Guineafowl*		55
Red-crested Korhaan		1
Black Korhaan* (pre-split)		34
Crowned Lapwing*		90
Blacksmith Lapwing*		91
Pied Avocet		25
Black-winged Stilt		56
Spotted Dikkop*		3
Double-banded Courser*		8
Namaqua Sandgrouse		36
Rock (Speckled) Pigeon		65
Red-eyed Dove*		29
Cape Turtle Dove*		44

Laughing Dove*		96
Namaqua Dove		79
Barn Owl*		4
Spotted Eagle Owl		1
White-rumped Swift		57
Little Swift		58
European Swallow (Barn)		32
White-throated Swallow		10
Greater Striped Swallow		70
Rock Martin		79
Brown-throated Martin		9
Pied Crow*		56
Mountain Chat		81
Familiar Chat*		78
Ant-eating Chat*		86
Karoo Scrub-Robin		55
Kalahari Scrub-Robin*		55
Black-chested Prinia*		66
Cape Wagtail*		95
Common Fiscal*l		94
White-browed Sparrow-weaver*		84
Sociable Weaver		1
House Sparrow*		83
Scaly-feathered Finch*		12
Red-billed Quelea*		34
Yellow Canary*		92

CE = Critically endangered, E = Endangered, VU = Vulnerable, NT = Near threatened, * = recorded during site visit.

Evaluation of avifaunal impacts

Issues relating to the CSP plant itself:

Collision with the heliostats (mirrors):

This is likely to impact on birds, but the extent to which it will occur is unknown at this stage. In the South African context, this impact will only become fully known and understood, once such projects have been established, and their interaction with avifauna has been monitored for a period of time. The impact on bird populations worldwide through them colliding with windows of buildings has been well documented (see www.flap.org). At Solar One, 81% of bird mortalities were through collision with structures, with >75% of these collisions having occurred with the heliostat mirrors themselves (McCrary *et al* 1986).

Collision with the central receiver tower:

Bird collisions with tall infrastructure have also been well documented world wide. However, this typically occurs with migratory species in flocking behavior and has usually involved low visibility conditions such as fog. There are unlikely to be sufficient numbers of any particular bird species at the site of the CSP plant to constitute flocking behavior thereby resulting in this risk. It is however likely that the occasional bird will collide with the tower.

Roosting on the central receiver tower:

The tower will be a prominent structure in the landscape and may be an attractive roost for certain bird species. Although it will be too hot during operation, as it cools down during the evenings it may be a very attractive (particularly during winter) if it retains some warmth (although the temperature it retains remains to be seen). If it is well lit at night, this may attract insects, thereby attracting birds. If birds do roost on the tower, this is likely to simply be a nuisance for plant staff, as bird pollution will build up on any available surfaces.

Burning when in vicinity of the central receiver:

It seems unlikely to be a significant impact as birds would presumably be repelled by the heat before they get within burning range. Certain particularly fast flying species may be impacted on, such as the doves, swifts, martins and swallows identified in table 3. Research at Solar One did not detect any mortalities through this mechanism (McCrary *et al* 1986).

Burning when entering the "standby focal points":

This impact is likely to occur at the CSP plant. At this stage it is safe to say that some birds will in all likelihood be killed in the focal points. The significance of the impact will depend on just how many birds, and what species are killed. Furthermore, it seems unlikely that any mitigation for this impact will be possible. Monitoring at Solar One recorded that 19% of all bird mortalities were through burning in standby or focal points – mostly swifts and swallows (McCrary *et al* 1986).

Loss of habitat:

Approximately 800ha will be taken up by the CSP plant in total. The vegetation in this area will should not be fully cleared automatically. Rather, only the areas where infrastructure has to be constructed should be cleared. Obviously construction activities on site will flatten and impact on certain areas of vegetation even if it is not cleared. Similar habitat is abundant in the greater area and it is anticipated that the bird species will move to surrounding areas.

Disturbance:

Construction activities will no doubt disturb the birds in the area, particularly breeding birds – however due to the uniformity of the broader area, these birds can quite easily move off and find similar habitat nearby.

Nesting of Sociable Weavers and other species on the plant infrastructure:

The extent to which this occurs will need to be monitored closely. This is an impact of the birds on the plant rather than the plant on the birds. It is hoped that the constant moving and cleaning of the heliostats will make them unattractive nesting substrate for the birds. No nests were observed within the site boundaries, however, some nests (such as the one shown in Fig. 9 below) were observed in the surrounding areas.

Figure 9: A sociable weaver nest on a manmade structure observed in the surrounding area.

Table 4: Rating of significance of impacts associated with CSP itself.

Impact	**Status**	**Temporal scale**	**Spatial scale**	**Probability**	**Severity**	**Significance**
Collision with heliostats	-	3	1	2	4	10 (Medium)
Collision with central receiver tower	-	3	1	2	4	10 (Medium)
Roosting on central receiver tower	N	3	1	2	1	7 (Medium)
Burning in vicinity of central receiver tower	-	3	1	1	4	9 (Medium)
Burning in focal points	-	3	1	2	4	10 (Medium)
Habitat loss	-	4	1	4	3	11 (Medium)
Disturbance	-	1	1	2	2	7 (Medium)
Nesting	+	3	1	1	1	6 (Medium)

Issues relating to associated infrastructure:

New power lines:

Collision of large terrestrial birds with overhead power lines is likely to occur and is anticipated to be the most significant threat posed by associated infrastructure. This will be especially relevant to large overhead power lines extending beyond the site. Species most likely to be affected are korhaans and other large terrestrial species. The significance of this impact depends on the length of new line to be built. In this case it appears that new line will be required from the CSP plant to a substation connecting with the High Voltage Line running to the South West of the site. The exact routing of this new line was not available at the time of the site visit, and it is probable that this infrastructure will form part of a separate EIA process all together. Therefore, **only the impacts of overhead powerlines within the CSP site boundary have been assessed at this stage**.

Electrocution of birds on pylons will depend entirely upon the exact pylon structure that for the new line – detail of which was not available at the time of this study. Electrocution risk is determined by the phase-phase and phase-earth clearances on a pole structure which differ greatly between different structures. Again, if the structure used is dangerous to birds, the significance of this impact will vary with the length of the line.

Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In the case of Sociable Weaver nests, the nest material may pose problems to the pylons structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests.

Disturbance of avifauna through construction and maintenance activities associated with the power line is not likely to be significant.

Habitat destruction by construction activities is likely to occur, but not likely to be significant.

Table 5. Rating of significance of impacts associated with new power lines

Impact	Status	Temporal scale	Spatial scale	Probability	Severity	Significance
Collision of birds	-	3	1	2	4	10 (Medium)
Electrocution of birds	-	3	1	1	4	9 (Medium)
Nesting	N	3	1	2	1	7 (Medium)
Habitat destruction	-	3	1	3	2	9 (Medium)
Disturbance	-	2	1	3	2	8 (Medium)

New roads:

Disturbance of avifauna is likely to occur to some extent, but not likely to be too significant as there is already a gravel district road (along the rail line to the west of the site) as well as various tracks through the farm and it is unlikely that extensive new roads would be, again depending on the final layout of the CSP plant within the farm.

Habitat destruction caused by road construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and so this impact is unlikely to be too significant.

Table 6. Rating of significance of impacts associated with new roads

Impact	Status	Temporal scale	Spatial scale	Probability	Severity	Significance
Habitat Destruction	-	4	1	3	3	11 (Medium)
Disturbance	-	2	1	3	2	8 (Medium)

New pipe lines:

This infrastructure is likely to have very similar impacts to the roads discussed above, except on a smaller scale. Should new pipelines be required for water supply to the CSP plant impacts of this on avifauna will be minor habitat destruction and minor disturbance.

Table 7. Rating of significance of impacts associated with new pipelines

Impact	Status	Temporal scale	Spatial scale	Probability	Severity	Significance
Habitat Destruction	-	2	1	2	2	7(Medium)
Disturbance	-	2	1	2	1	6 (Medium)

Comparison of Alternatives

For the purpose of the proposed EIA only the following types of alternative options will be considered:

- The design or layout of the activity
- The technology to be used in the activity
- The option of not implementing the activity (i.e. "No-go").

For the proposed CSP various plant design or layout positions on the proposed site will be assessed as alternatives. Three possible technology alternatives have been identified as development options and will be considered and assessed. The no-go alternative will also be assessed in order to reflect the potential impact if the proposed project will not be implemented.

No-go Alternative

The current status quo would be maintained by not implementing the proposed CSP Plant. The current farming activities will continue and the land use will not change. Presence and abundance of bird species, as described in the Avifaunal Scoping Report, would remain the same. Purely in terms of impacts on avifauna, this option would have the least impacts.

Location Options

The options for the proposed location of the CSP are limited to the remainder of the Farm 469 (Humansrus), Hay RD. However more than one design or layout option of the proposed plant on the selected site will be investigated. No alternative site locations have been assessed.

Technology Options

The three technology alternatives that are being considered relates to the water consumption of the plant and particularly the consumption of the cooling systems. The cooling system is the only variable in terms of water consumption. The three cooling system options are dry, wet and hybrid cooling. The estimated water consumption during the construction phase remains constant irrespective of the cooling option chosen. The consumption during operation however will be influenced by the selected cooling system. The dry system consumes approximately 90% less water than the wet system and moderately less than the hybrid cooling system and the availability of water will be a determining factor of the option to be selected.

It is unlikely that there will be any direct impacts on avifauna, relating to the type of cooling system chosen. However, as birds are dependent on water, the wet system may have more negative, indirect impacts on avifauna, through the possible depletion of water availability and wetland habitats. This of course is dependent on the source of the water used.

Site Layout options.

An avifaunal sensitivity map has been compiled (see figure 10 below), showing areas of medium-high, low-medium, and unknown sensitivities. Recommendations with regard to these sensitivity "zones" has been discussed below. It is recommended that infrastructure is not built or developed in the zone of medium to high sensitivity.

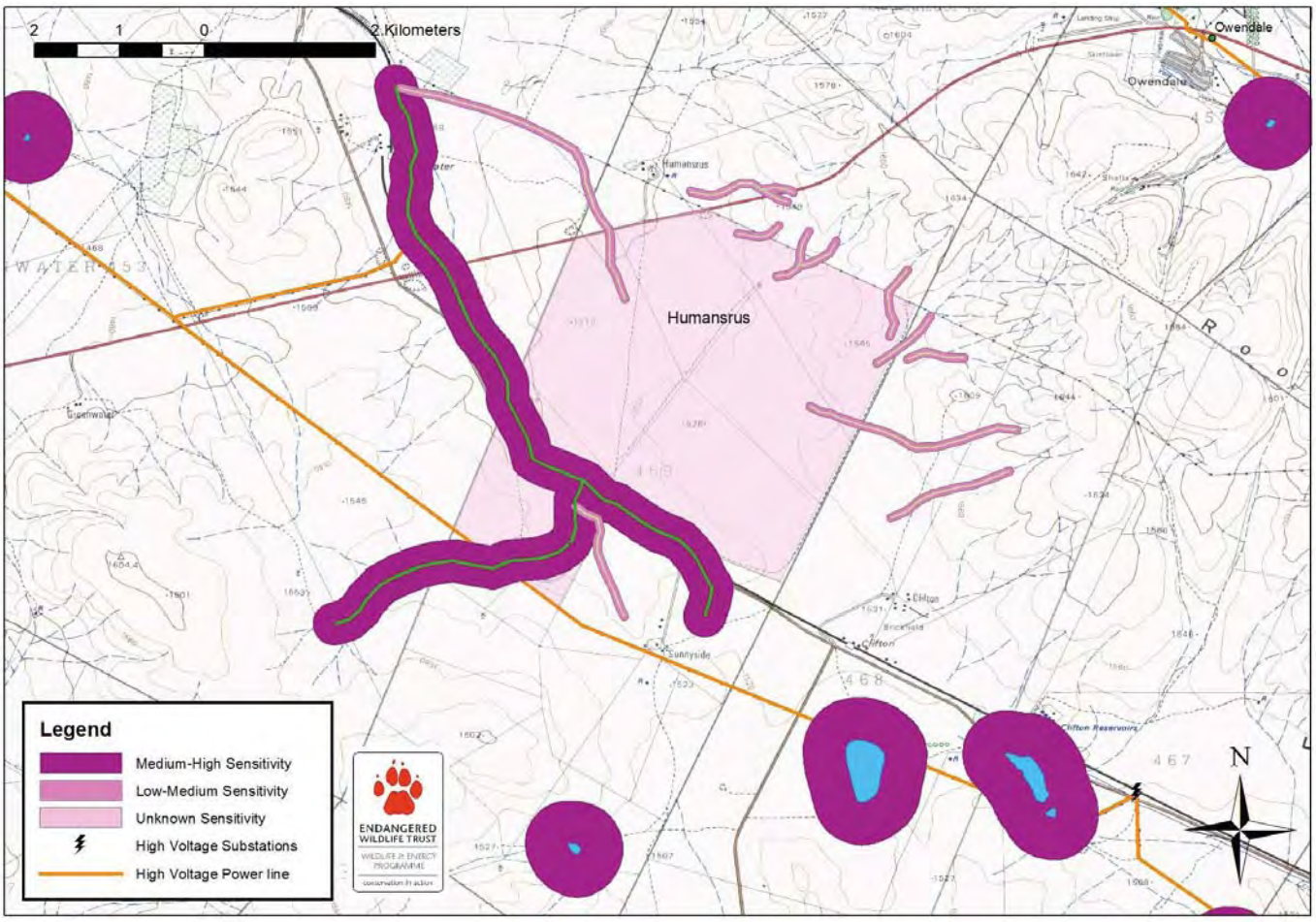

Figure 10: A map showing various avifaunal sensitivity zones within the proposed development site.

Medium-High sensitivity: These zones include 250m buffers around water bodies, such as dams and pans, as well as 100m buffer around a seasonal drainage line/wetland area, identified using GIS and confirmed during the site visit, to the south and west of the study site. No construction of CSP infrastructure in these areas (as indicated in the map above- Figure 26) should be permitted. However, upon consultation with EWT, construction of infrastructure may be possible, with caution, within certain areas of these zones. Should associated infrastructure, such as pipe-lines or power lines pass through these areas, mitigation as discussed elsewhere must be implemented. Importantly, should any over-head powerlines pass through these areas; they should be fitted with collision mitigation in the form of "bird flight diverters". The confidence with which these "Medium-High sensitive" areas were identified was moderate.

Medium- Low Sensitivity: These zones are likely to be of low sensitivity; however, in times of good rainfall, they may attract more birds and then can be regarded as having medium sensitivity. They

include 50m buffers around drainage line identified at a desk-top level, but were not apparent on the ground during the site visit. It is recommended, that where possible, infrastructure should avoid these areas.

Unknown Sensitivity: These are the remaining areas of the study site. These are designated "unknown" sensitivity for the following reasons: no obvious avifaunal features or patterns could be identified during the study; any of the identified focal species may at some point utilize or pass through these areas, and; the precautionary principle has been adopted. It is likely that the majority of these areas are *"Low"* sensitivity for birds. These unknown sensitivity areas are preferred for construction.

Conclusions and Mitigations

The site is in the arid Kalahari and Nama Karoo Biomes of the Northern Cape, with uniform vegetation of only two types (Olifantshoek Plains Thornveld and Kuruman Mountain Bushveld) found on the study site. The uniformity of the site resulted in few microhabitats available for birds. There were no major water bodies or wetlands on site, with only one small dam and a narrow "vlei" area to the south west of the site. This area has been buffered and designated as medium-high sensitivity. The presence of three CWAC sites to the East of the study area, means that it is possible for waterfowl and other bird species associated with water, may be attracted to additional water sources (e.g. evaporation ponds) created by the CSP project. Of particular concern here is the Greater Flamingo. The level of confidence with which the various impacts are discussed is relatively low, primarily due to a lack of exposure to such projects within the South Africa. However, a prediction of the impacts of the proposed CSP plant on avifauna at Humansrus revealed the following key findings:

Impacts associated with CSP plant:

- Collision of birds with heliostats is likely to be of medium significance.
    - *Mitigation:* It is unlikely that mitigation of this impact will be possible, but this will need to be confirmed once the plant is operational and some experience is gained.
- Burning of birds in focal points will be of medium significance.
    - *Mitigation:* Again, it is unlikely that mitigation of this impact will be possible, but this will need to be confirmed once the plant is operational and some experience is gained.
- Habitat destruction and disturbance of bird will be of medium significance.

- *Mitigation:* This can be mitigated by ensuring that the construction Environmental Management Plan incorporates guidelines as to how best to minimize this impact.

Impacts associated with new power lines:

- Collision of birds with overhead power lines is likely to be of medium significance.
  - *Mitigation:* This will be mitigated for by marking the relevant sections of line (i.e. those within the Medium-High Sensitivity zones, as depicted in figure 10 above) with appropriate marking devices. These sections of line, and the exact spans, will be finalised as part of the Environmental Management Programme (EMP) phase, once power-line routes are finalised and pylon positions are pegged.
- Electrocution of birds is likely to be of medium significance.
  - *Mitigation:* Any overhead power lines which are built within the site, and which are 132kV or lower, should use a "bird friendly" monopole structure, fitted with a bird perch, as per Eskom standard guidelines.

Impacts associated with new roads, pipe lines.

- Habitat destruction and disturbance of birds will be of medium significance.
  - *Mitigation:* This will be mitigated by ensuring that the construction EMP incorporates guidelines as to how best to minimize this impact.

A final recommendation is that a detailed monitoring protocol, for the operational phase of the project, be incorporated in to the final project EMP. The EWT should be consulted during the EMP phase, to assist in compiling such a monitoring program. The monitoring will involve regular inspections of the plant, to collect any bird carcasses. This will insure that any bird mortalities are recorded and reported, and may assist with the implementation of future, additional mitigation strategies.

Appendix 1

Significance Rating Methodology

Although specialists are given free reign on how they conducted their research and obtained information, they are requested to provide the reports in a specific layout and structure, so that a uniform specialist report volume can be produced. To ensure a direct comparison between various specialist studies, six standard rating scales are defined and used to assess and quantity the identified impacts. The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on three criteria, namely:

- The relationship between impacts/issues and impact status (Box 1);
- The relationship between impacts/issues and spatial scale (Box 2);
- The relationship between impacts/issues and temporal scale (Box 3);
- The relationship between impacts/issues and probability (Box 4
- The relationship between impacts/issues and severity (Box 5);

These three criteria are combined to describe the overall importance rating, namely the significance (Box 6).

Box 1: Status of impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment.	+
Neutral	No cost or benefit to the receiving environment.	N
Negative	A cost to the receiving environment.	-

Box 2: Spatial scale of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Low	Site Specific; Occurs within the site boundary.	1
Medium	Local; Extends beyond the site boundary; Affects the immediate surrounding environment (i.e. up to 5km from Project Site boundary).	2
High	Regional; Extends far beyond the site boundary; Widespread effect (i.e. 5km and more from Project Site boundary).	3
Very High	National and/or international; Extends far beyond the site boundary; Widespread effect.	4

Box 3: Temporal scale of impacts

Rating	Description	Quantitative

		Rating
None	No impact	0
Low	Short term; Quickly reversible; 0 – 5years.	1
Medium	Medium term; Reversible over time; 5 – 15 years.	2
High	Long term; Approximate lifespan of the project: 16 -30 years.	3
Very High	Permanent; over 30 years and resulting in a permanent and lasting change that will remain.	4

Box 4: Probability of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Improbable	Possibility of the impact materialising is negligible; Chance of occurrence <10%.	1
Probable	Possibility that the impact will materialise is likely; Chance of occurrence 10 – 49.9%.	2
Highly Probable	It is expected that the impact will occur; Chance of occurrence 50 – 90%.	3
Definite	Impact will occur regardless of any prevention measures; Chance of occurrence >90%.	4

Box 5: Severity of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Negligible / Minor	The system(s) or party(ies) is marginally affected by the proposed development.	1
Average	Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example, a temporary fluctuation in the water table due to water abstraction.	2
Severe	Medium to long term impacts on the affected system(s) or party (ies) that could be mitigated. For example constructing a narrow road through vegetation with a low conservation value.	3
Very Severe	An irreversible and permanent change to the affected system(s) or party(ies) which cannot be	4

Rating	Description	Quantitative Rating
	mitigated. For example, the permanent change to topography resulting from a quarry.	

Box 6: Significance of impacts

Impact	Rating	Description	Quantitative Rating
Positive	High	Of the highest positive order possible within the bounds of impacts that could occur.	+ 12 – 16
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other means of achieving this benefit are approximately equal in time, cost and effort.	+ 6 – 11
	Low	Impacts is of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	+ 1 – 5
No Impact	No Impact	Zero impact.	0
Negative	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.	- 1 – 5
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action may be required.	- 6 – 11

	High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt.	- 12 - 16

References

Barnes, K.N. (ED.) 1998. The Important Bird Areas of Southern Africa. Birdlife South Africa, Johannesburg.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa: Johannesburg.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.

McCRARY, M.D., McKERNAN, R.L., SCHREIBER, R.W., WAGNER, W.D. & SCIARROTTA, T.C. 1986. Avian mortality at a solar energy power plant. Journal of Field Ornithology Vol 57 (2) pp 135-141.

Mucina & Rutherford. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. Coordinated waterbird Counts in South Africa, 1992-1997. Avian Demography Unit, Cape Town.

Young, D.J., Harrison, J.A, Navarro, R.A., Anderson, M.A., & Colahan, B.D. (Eds). 2003. Big birds on farms: Mazda CAR Report 1993-2001. Avian Demography Unit: Cape Town.