
ENVIRONMENTAL IMPACT ASSESSMENT FOR THE
PROPOSED HUMANSRUS SOLAR 3 PV FACILITY
DEVELOPMENT, SOUTH-WEST OF PRIESKA, NORTHERN
CAPE:
AVIFAUNAL IMPACT STUDY



Produced for Cape EAPrac on behalf of Humansrus Solar 3 (Pty) Ltd by:



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EXECUTIVE SUMMARY

Simon Todd Consulting was enlisted by Humansrus Solar 3 (Pty) Ltd to undertake an avifaunal impact study for the proposed Humansrus Solar 3 75 MW commercial photovoltaic Solar Energy Facility (SEF) south-west of Prieska in the Northern Cape Province. The development will consist of solar panels covering an area of 200-230 hectares, an on-site substation, auxiliary buildings, access and internal roads and a 132kV power line linking the facility to the national grid.

Up to 140 bird species are known to occur within the study area and broader impact zone of the development, including 11 red-listed or threatened species, 18 endemic species and 33 near-endemic species. The birds of greatest potential relevance and importance in terms of the possible impacts of the solar energy facility and its associated power infrastructure are likely to be local populations of endemic passerines, shy ground-nesting species, resident or visiting large terrestrial birds, resident or passing raptors and transient waterbirds.

The development will pose several impacts to avifauna, including: a **medium-low** displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed SEF and its associated power infrastructure and a **low** impact of electrocutions of birds on power infrastructure and avian collisions with power line infrastructure and solar panels, with the implementation of mitigation measures.

The study area and more specifically the recommended development area are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded on-site – Kori Bustard and Karoo Korhaan –the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low.

The proposed Humansrus Solar 3 SEF and its associated power infrastructure has been assessed as having a **medium-low** impact to priority species and general avifauna occurring in the study area and broader impact zone of the development and it has been recommended that the preferred site layout option be used for the development.

DECLARATION OF INDEPENDENCE

I, **Blair Zoghby**, in my capacity as a specialist consultant, hereby declare that I:

- Act/acted as an independent specialist to Cape EAPrac for this project.
- Do not have any personal, business or financial interest in the project except for financial remuneration for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014.
- Will not be affected by the outcome of the environmental process, of which this report forms part of.
- Do not have any influence over the decisions made by the governing authorities.
- Do not object to or endorse the proposed developments, but aim to present facts and my best scientific and professional opinion with regard to the impacts of the development.
- 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, 2014.

PROFESSIONAL EXPERIENCE

Simon Todd Consulting has extensive experience in the assessment of renewable energy developments, having provided ecological assessments for more than 100 different renewable energy developments. This includes a variety of facilities in the immediate vicinity of the current site as well as in the broader North Cape region. Simon Todd is a recognised arid-areas ecological expert and is a past chairman of the Arid-Zone Ecology Forum and has 18 years' experience working throughout the country. Simon Todd is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Blair Zoghby has been involved in ornithological conservation and research for eight years and holds an MSc degree in Zoology/Conservation Biology obtained through the Percy FitzPatrick Institute of African Ornithology, University of Cape Town, South Africa. He has undertaken numerous avian impact assessments across the country and as such, has experience working with a wide variety of bird species and bird habitats.

INDEMNITY

- This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- This report is based on a desktop investigation using available information and data related to the site to be affected, *in situ* fieldwork, surveys and assessments and the specialists best scientific and professional knowledge.
- The Precautionary Principle has been applied throughout this investigation.
- The findings, results, observations, conclusions and recommendations given in this report are based on the specialist's best scientific and professional knowledge as well as available information at the time of study.
- 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 reserves the right to modify 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.
- 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 as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgement of these terms and liabilities.



Blair Zoghby



Simon Todd Pr.Sci.Nat 400425/11.

February 2016

1. INTRODUCTION

1.1. BACKGROUND

Humansrus Solar 3 (Pty) Ltd, a renewable energy developer, is proposing the establishment of a 75 MW commercial photovoltaic (PV) solar energy facility (SEF) on a portion of Farm 147 Humansrus south-west of Prieska in the Northern Cape Province.

The National Environmental Management Act (NEMA) (Act 107 of 1998) requires that an Environmental Impact Assessments (EIA) be conducted for any development which could have a significant effect on the environment, with the objective to identify, predict and evaluate the actual and potential impacts of these activities on ecological systems; identify alternatives; and provide recommendations for mitigation to minimize the negative impacts. The results of the EIA are then lodged with the National Department of Environmental Affairs (DEA) for further examination before an outcome of authorisation for the development is given.

In order to meet these requirements and manage the EIA process, Humansrus Solar 3 (Pty) Ltd has appointed Cape EAPrac as independent environmental assessment practitioners. As part of the specialist studies required for the EIA, Cape EAPrac has enlisted Simon Todd Consulting to provide an avifaunal impact study of the developable area.

The purpose of the avifaunal impact study is to describe and detail the avian ecological features of the proposed site, provide an assessment of the avian ecological sensitivity of the site, identify and assess the significance of the likely impacts associated with the development and provide measures to avoid, minimize and mitigate project related impacts to avifauna.

1.2. RELEVANT ASPECTS OF THE DEVELOPMENT

- The proposed developable area of the Humansrus Solar 3 SEF is located on a portion of Farm 147 Humansrus, with a preliminary study area of 852 ha in which to site the development.
- The proposed SEF is planned and designed with a net generating capacity of 75 MW of power.
- The proposed developable area required to meet the proposed capacity will cover an area of around 200-220 ha.
- Two site layout options have been included in the assessment. The preferred site layout is approximately 220 ha in extent (including exclusionary areas for sensitive features), while the alternative site layout is approximately 240 ha.
- Grid connection will be via a 132kV power line from the on-site substation south-west to the Kronos Eskom substation. Approximate length of line: 6 km.

- Infrastructure associated with the SEF is likely to include:
- PV and/or concentrated PV panels, with fixed, single or double axis tracking technology;
- Auxiliary buildings for control, equipment and maintenance;
- Cabling between the above-mentioned infrastructures;
- Access roads and internal roads; and
- Fencing surrounding the facility.



Figure 1: Satellite image of the Humansrus Solar 3 SEF illustrating the property boundaries (white), study area (black), preferred site layout (red), alternative site layout (blue), location of the on-site substation, and grid connection to the Kronos Eskom substation (purple).

1.3. RELEVANT LEGISLATION AND GUIDELINES

The following legislation is applicable to the proposed development:

1.3.1. The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is an international convention (to which South Africa is a signatory) and represents a commitment to sustainable development. The Convention has three main objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources (<http://cbd.int/convention/guide/>). Although the convention does not include specific recommendations or guidelines pertaining to birds and energy

infrastructure interactions and impacts, it does make provisions for keeping and restoring biodiversity.

1.3.2. The Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) is an intergovernmental treaty and is the most appropriate instrument to deal with the conservation of terrestrial, aquatic and avian migratory species. The convention includes policy and guidelines with regards to the impact associated with man-made infrastructure. CMS requires that parties (South Africa is a signatory) take measures to avoid migratory species from becoming endangered (Art II, par. 1 and 2) and to make every effort to prevent the adverse effects of activities and obstacles that seriously impede or prevent the migration of migratory species i.e. power lines (Art 111, par. 4b and 4c).

1.3.3. The Agreement on the Conservation of African-Eurasian Migratory Water Birds

The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitat across Africa, Europe, the Middle East Central Asia, Greenland and the Canadian Archipelago. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle and is a legally binding agreement by all contracting parties (South Africa included) to guarantee the conservation of migratory waterbirds within their national boundaries through species and habitat protection and the management of human activities.

1.3.4. The National Environmental Management: Biodiversity Act

The National Environmental Management: Biodiversity Act (No. 10 of 2004, NEMBA) regulations on Threatened and Protected Species (TOPS) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. The national Act and several sets of provincial conservation legislation provide for among other things, the management and conservation of South Africa's biodiversity; protection of species and ecosystems that necessitate national protection and the sustainable use of indigenous biological resources.

1.3.5. Guidelines to minimise the impacts on birds of Solar Facilities and Associated Infrastructure in South Africa

The "Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa" (Smit, 2012) is perhaps the most important (although not legally binding) document from an avifaunal impact perspective currently applicable to solar development in South Africa. The guidelines are published by BirdLife South Africa (BLSA) and detail the recommended procedure for conducting an avifaunal specialist study as well as list all of the potential impacts of interactions between birds and solar facilities and

associated infrastructure. We are aware of changes to the BirdLife South Africa best-practise guidelines recently published at the Birds and Renewable Energy Forum in Johannesburg (2015) and although the revised requirements are still a work in progress and have not yet been ratified, they will inform this assessment where applicable.

1.4. TERMS OF REFERENCE

The specific terms of reference for this avifaunal impact study include the following:

- A description of the environment of the study area in terms of the avian habitats present.
- A consolidated list of bird species and priority bird species (priority species will include nationally and/or globally threatened, rare, endemic or range-restricted bird species) likely to occur within the study area and broader impact zone of the development, with information on the relative value (in terms of breeding, nesting, roosting and foraging) of the site for these birds.
- A description of the likely seasonal variation in the presence/absence of priority species and observations of their movements throughout the study area;
- A delineation of areas that are potentially highly sensitive, no-go areas that may need to be avoided by the development.
- A description and evaluation of the environmental issues and potential impacts (including direct, indirect and cumulative impacts) that the proposed development may have on the bird species present. Direct, indirect and cumulative impacts of the identified issues will be evaluated for various stages of the development and according to predefined criteria.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- A comparative evaluation of feasible site alternatives and nomination of a preferred site alternative for the development.
- A description of any mitigation measures that may be required to manage impacts related to the monitoring and assessment of the site.

1.5. STUDY METHODOLOGY

1.5.1. Approach

The avifaunal impact study included the following steps:

- A review of all available published and unpublished literature pertaining to bird interactions with SEFs and their associated power infrastructure, summarising the issues involved and the current level of knowledge in the field. Various information

sources including data on the local avifauna of the area and previous studies of bird interactions with SEFs and their associated power infrastructure were examined.

- A site visit of 3 days to the study area (22-24 February 2016) to determine the *in situ* local avifauna and avian habitats present on site to:
 - Quantify aspects of the local avifauna (such as species diversity and abundance);
 - Identify important avian features present on site (such as nesting and roosting sites);
 - Confirm the presence, abundance, habitat preference and movements of priority species;
 - Identify important flyways across the site; and
 - Delineate any obvious, highly sensitive, no-go areas to be avoided by the development.
- The compilation of a consolidated and annotated list of the avifauna likely to occur within the study area and the broader impact zone of the development based on a combination of existing distributional data, species seen during the site visit and previous experience of the avifauna of the area.
- The compilation of a short-list of priority bird species (including nationally and/or globally threatened, rare, endemic or range-restricted bird species) which could be affected by the proposed development. These species will subsequently be considered as adequate surrogates for the local avifauna in general, and mitigation of impacts on these species will be considered likely to accommodate any less important bird populations that may also potentially be affected.
- An avian site sensitivity map was generated by integrating avian microhabitats present on site and avifaunal information collected during the site visit. The avian sensitivity of the different units identified in the mapping procedure were rated according to the following scale:
 - *Low*: Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and avifauna. Most types of development can proceed within these areas with little ecological impact.
 - *Medium*: Areas of natural or previously transformed land where the impacts are likely to be largely local. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological and avian impacts provided that appropriate mitigation measures are taken.
 - *High*: Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

- *Very High*: Critical and unique habitats that serve as habitat for rare, threatened, endemic or range-restricted species and/or perform critical ecological roles. These areas are essentially no-go areas from a development perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as *Medium-High*, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

- The construction of a matrix of potential impacts of the development on the local avifauna is drawn up and the significance of these impacts assessed.
- A final statement on the overall significance of the potential impacts of the development on the avifauna of the area is provided.

1.5.2. Data sources used

The following data sources and reports were used in varying degrees of detail for this study:

- The Southern African Bird Atlas Project 1 (SABAP 1; Harrison *et al.*, 1997) quarter degree squares (QDC) 2922CD (8 cards) and 3022AB (8 cards) as well as the Southern African Bird Atlas Project 2 (SABAP 2; <http://sabap2.adu.org.za/index.php>) pentads 2955_2220 (10 cards), 2955_2225 (12 cards), 3000_2220 (3 cards) and 3000_2225 (2 cards) were consulted to determine the bird species likely to occur within the study area and the broader impact zone of the development.
- The conservation status, endemism and biology of all species considered likely to occur within the study area was then determined from Hockey *et al.* (2005) and Taylor *et al.* (2015).
- The South African National Vegetation Map (Mucina & Rutherford, 2006) was consulted in order to determine the vegetation types and their conservation status that occur within the study area.

1.5.3. Limitations and assumptions

The specialist made the assumption that the sources of information used in the compilation of this report are reliable. However, it must be noted that there are limiting factors and these could detract from the accuracy of the predicted results:

- There is a scarcity of published, scientifically vetted information regarding the avifaunal impacts at existing SEFs. Recent studies at SEFs (all using different solar technologies) in southern California have revealed that a wide range of bird species are susceptible to morbidity and mortality at SEFs, regardless of the type of technology employed. It must however be noted, that facility related factors could influence impacts and mortality rates and as such, each SEF must be assessed individually, taking all variables into account.

- Assessment of the impacts associated with bird-SEF interactions is problematic due to: (i) limitations on the quality of information available describing the composition, abundance and movements of the local avifauna, and (ii) the complete absence of any local, empirical data describing the known impacts of existing SEFs on birds (Jenkins, 2011).
- Limited time in the field and no seasonal spread means that important components of the local avifauna (i.e. nest sites or localised areas of key habitats for rare or threatened species) could have been missed. However, the development area does not contain many large trees, so it is highly unlikely that there are any significant nesting sites of larger species present within the affected area that would not have been observed.

The site visit as well as personal experience of the avifauna of the area and of similar species in different parts of South Africa, through the specialist's experience working across the country, goes some way to remedying any knowledge deficiencies.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1. BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford, 2006), the site falls within two vegetation types - Bushmanland Arid Grassland and Bushmanland Basin Shrubland (Figure 2). Bushmanland Arid Grassland is made up largely of extensive plains dominated by white grasses and patches of low shrub. It is classified as Least Threatened, with very little of the area of this vegetation type having been transformed. Bushmanland Basin Shrubland is composed of dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs, white grasses and in years of high rainfall also by abundant annuals. This vegetation type is also classified as *Least Threatened*.

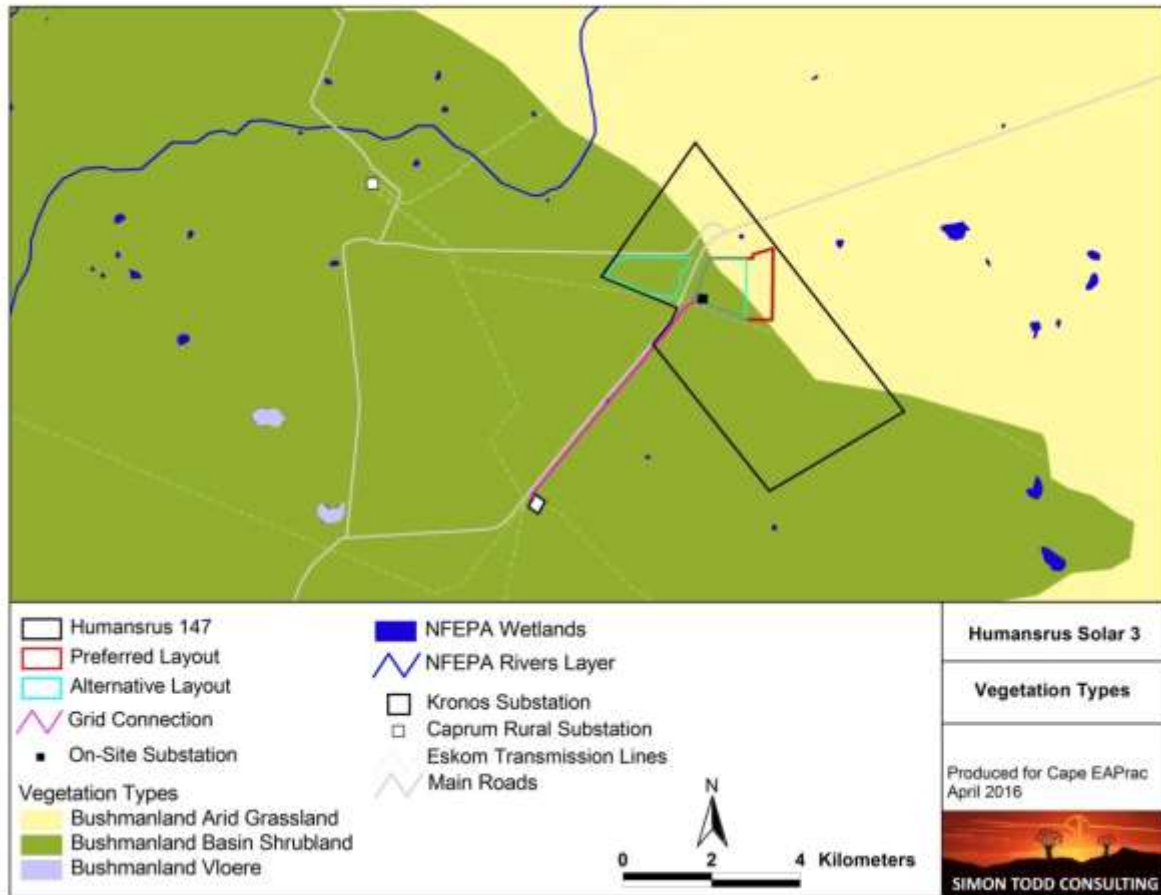


Figure 2. National vegetation map for the Humansrus Solar 3 site and surrounding area.

2.2. AVIAN MICROHABITATS

While broad-scale vegetation patterns influence the distribution and abundance of bird species holistically, it is the fine-scale vegetation patterns and various avian microhabitats in an area that determine local avifauna populations.

Only two distinctly different avian microhabitats were identified at the site and these formed the basis of the avian site sensitivity map. These units include:

- *Ephemeral pans*: There are a number of ephemeral pans (which will only hold water after heavy rains) scattered around the study area. This habitat unit is important for numerous species, as it is the only reliable source of surface water in the area, but is specifically important for endemic and threatened waterbirds (Greater Flamingo *Phoenicopterus ruber* and South African Shelduck *Tadorna cana* respectively). Some of the features are man-made and have their origin as borrow pits, but due to their long-term presence at the site, they have become important avifaunal features and many species are likely to use these areas on a regular basis as part of their

wider range which includes numerous isolated pans and other larger aquatic features such as the Orange River.

- *Karoo grassland/shrubland*: This habitat unit represents the majority of the vegetation in the study area (Bushmanland Arid Grassland and Bushmanland Basin Shrubland) and is largely made up of extensive plains of white grasses and low shrubs. Although this habitat unit does not support the highest diversity and abundance of species, it does support numerous species of conservation concern (Kori Bustard *Ardeotis kori*, Ludwig's Bustard *Neotis ludwigii* and Karoo Korhaan *Eupodotis vigorsii*) as well as endemic and near-endemic passerine species.

It should however be noted, that the study area has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. Evidence of high stocking rates and grazing pressure is apparent. There is also a network of minor farm roads throughout.



Figure 3: Example of shrubby grassland (left) and shrubland (right) typical of the site.



Figure 4: Ephemeral pan holding water after heavy rains.

2.3. AVIFAUNA

Up to 140 bird species are known to occur within the study area and broader impact zone of the development (Appendix 1), including 11 red-listed or threatened species (Table 1), 18 endemic species and 33 near-endemic species. Of these, 40 species were recorded during the site visit, most notable of which being the sightings of Karoo Korhaan and Kori Bustard, with the latter occurring in large numbers across the entire study area (6 different sightings, 13 individuals recorded).

The birds of greatest potential relevance and importance in terms of the possible impacts of the SEF and its associated power infrastructure are likely to be local populations of threatened or endemic passerines (Sclater's Lark *Spizocrys sclateri*, Karoo Long-billed Lark *Certhilauda subcoronata*, Large-billed Lark *Galerida magnirostris*, Ant-eating Chat *Myrmecocichla formicivora* and Sickle-winged Chat *Cercomela sinuate*), shy ground-nesting species (Burchell's Courser *Cursorius rufus* and Double-banded Courser *Rhinoptilus africanus*), resident or visiting large terrestrial birds (Kori Bustard, Ludwig's Bustard, Karoo Korhaan and Secretarybird *Sagittarius serpentarius*), resident or passing raptors (Lanner Falcon *Falco biarmicus* and Martial Eagle *Polemaetus bellicosus*) and transient waterbirds (Greater Flamingo).

As previously mentioned, during the site visit (22-24 February 2016) there was a noticeably high density of Kori Bustards present throughout the study area, possibly in response to a recent insect emergence. Otherwise, besides the high diversity and abundance of bird species present around the *Ephemeral pans* habitat unit (30% of the species recorded during the site visit), in general, bird diversity and abundance across the study area was relatively low.

On the basis of the observations recorded during the field visit, and in combination with already documented information on the avifauna of the study area, 11 priority species are considered central in this avifaunal impact study (Table 1). These are mostly threatened species which are known to occur, or could occur, in relatively high numbers in the study area and the broader impact zone of the development and which are likely to be, or could be, negatively affected by the SEF. Two species, Kori Bustard and Karoo Korhaan, were recorded within the study area.

Overall, the avifauna of the study area and the broader impact zone of the SEF is not considered unique and is typical of what occurs across large areas of the Nama Karoo Biome, which therefore suggests that the sensitivity of the site, from an avian perspective, will not be of any great significance.

Table 1: Priority species list considered central to the avifaunal impact study for the proposed Humansrus Solar 3 SEF, selected on the basis of conservation status (Taylor *et al.*, 2015).

Common name	Scientific name	Conservation status	Regional endemism	Estimated importance of local population	Preferred habitat	Likelihood of occurring in study area	Susceptible to
Bustard, Kori	<i>Ardeotis kori</i>	Near-threatened	-	Moderate	Dry open savanna woodland, dwarf shrubland and occasionally grassland	Recorded	Collision
Bustard, Ludwig's	<i>Neotis ludwigii</i>	Endangered	Endemic	Moderate-High	Semi-arid dwarf shrubland, also in arid savanna and fynbos	Moderate	Collision
Courser, Burchell's	<i>Cursorius rufus</i>	Vulnerable	Near-endemic	Low	Sparsely vegetated arid regions	Low	Disturbance
Eagle, Martial	<i>Polemaetus bellicosus</i>	Endangered	-	Moderate	Open savanna and woodland on plains, also semi-arid shrublands	Moderate	Collision, electrocution
Eagle, Verreaux's	<i>Aquila verreauxii</i>	Vulnerable	-	Low	Mountainous regions and rocky areas with cliffs	Low	Collision
Falcon, Lanner	<i>Falco biarmicus</i>	Vulnerable	-	Moderate	Open grassland or woodland near cliffs and electricity pylons	Moderate	Collision, disturbance
Flamingo, Greater	<i>Phoenicopterus ruber</i>	Near-threatened	-	Moderate	Saline or brackish water bodies; flyover	Moderate	Collision
Harrier, Black	<i>Circus maurus</i>	Near-threatened	-	Low	Fynbos, shrubland, dry grassland and croplands	Low	Collision, disturbance
Korhaan, Karoo	<i>Eupodotis vigorsii</i>	Near-threatened	Endemic	Moderate	Shrublands	Recorded	Collision, disturbance
Lark, Sclater's	<i>Spizocorys sclateri</i>	Near-threatened	Near-endemic	Moderate	Arid to semi-arid sparsley vegetated stony plains	High	Disturbance
Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable	-	Moderate	Open grassland with scattered trees and shrubs	High	Collision

2.4. AVIAN SITE SENSITIVITY MAP

The avian site sensitivity map (Figure 5) was generated by integrating avian microhabitats present on site and avifaunal information collected during the site visit. It is important to delineate sensitive avian microhabitats within the study area in order to ensure the development does not have a long term negative impact on these habitats. Important avian microhabitats in the developable area play an integral role within the landscape, providing nesting, foraging and reproductive benefits to the local avifauna.

Two sections within the study area have been assessed as being of *Very High* avian sensitivity. These areas were associated with the *Ephemeral pans* habitat unit, where bird diversity and abundance was high. These are foci of avifaunal activity and as they are not common features in the landscape disturbed birds may have to travel a long way to find alternative sites. As such, disturbance to these areas should be reduced as much as possible and it is recommended that a 100m buffer for development is instituted around these features.

The remainder of the study area, despite the presence of high densities of a priority species (Kori Bustard), was assessed as being of *Medium* avian sensitivity. The vegetation in these areas is associated with the *Karoo grassland/shrubland* habitat unit which is fairly homogenous across the study area. This habitat unit lacks structural and composition variation and therefore does not support a high diversity or abundance of bird species.

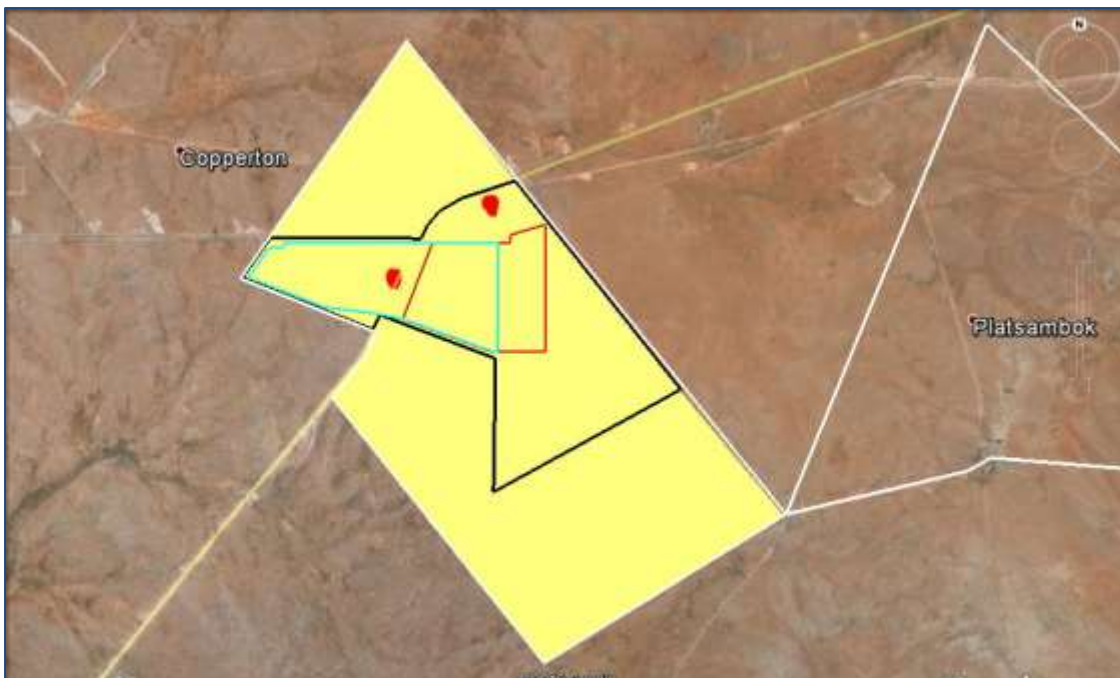


Figure 5: Avian site sensitivity map of the Humansrus Solar 3 SEF illustrating the property boundaries (white), study area (black), preferred site layout (red) and alternative site layout (blue). Avifaunal sensitivity: Yellow = *Medium* and Red = *Very High*.

3. ASSESSMENT OF IMPACTS

3.1. GENERAL DESCRIPTION OF BIRD INTERACTIONS WITH SOLAR ENERGY FACILITIES AND THEIR ASSOCIATED POWER INFRASTRUCTURE

While renewable energy sources, such as solar energy, are important to the future development of power generation and hold great potential to alleviate the dependence on fossil fuels, they are not without their environmental risks and negative impacts. Poorly sited or designed SEFs can have negative impacts on not only vulnerable species and habitats, but also on entire ecosystem functioning. These impacts are extremely variable, differing from site to site, and are dependent on numerous contributing factors which include the design and specifications of the development, the importance and sensitivity of avian microhabitats present on site and the diversity and abundance of the local avifauna.

3.1.1. Impacts of solar energy facilities

Habitat loss

Although the degree of this impact is dependent on the location and scale of the development, this is potentially the most significant impact associated with the construction and operation (maintenance) of SEFs. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). Given the considerable space requirements of commercially viable facilities (> 200 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and allowing for the possible cumulative effects of multiple facilities in one area. This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges, as entire territories could be removed during construction activities.

Disturbance and displacement

Construction of SEFs requires a significant amount of machinery and labour to be present on site for a period of time. For shy, sensitive species or ground-nesting birds resident in the area, construction activities are likely to cause a temporary disturbance or even result in displacement from the site entirely. In addition, species commuting around the site may become disorientated by the reflected light and consequently fly longer distances to avoid the area, potentially resulting in displacement and energy implications (Smallie, 2013). Similarly, but to a lesser extent, ongoing maintenance activities at the operational facility are likely to cause some degree of disturbance to birds in the general vicinity.

Mortality

Bird mortality has been shown to occur due to direct collisions with solar panels. Species affected include waterbirds, small raptors, doves, sparrows and warblers (Kagan et al., 2014). The reflective surfaces of PV panels may confuse approaching birds and in some

cases act as an attractant, being mistaken for large water bodies, resulting in injuries and/or mortalities when birds attempt to land on the installations.

Human conflict

Certain bird species may seek to benefit from the installations, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (i.e. plants growing under the panelling and other animals attracted to the facility). This may result in the fouling of critical components in the solar array, bringing local bird populations into conflict with facility operators.

3.1.2. Impacts of associated power infrastructure

Collisions with power infrastructure

Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species. These are mostly heavy-bodied birds such as bustards, cranes, storks, large eagles and various species of waterbirds that have limited manoeuvrability in flight, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Anderson, 2001; van Rooyen 2004a; Jenkins *et al.*, 2010).

Electrocutions on power line and power infrastructure

Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.*, 2007). Electrocution risk is strongly influenced by the power line voltage and the design of the pole structure and mainly affects larger, perching species such as vultures, eagles and storks that are capable of spanning the spaces between energised components.

Habitat destruction and disturbance associated with the construction and maintenance of power lines, substations and service roads

During the construction phase and maintenance of power lines, substations and service roads, some habitat destruction and alteration inevitably takes place. These activities have an impact on birds breeding, foraging and roosting in close proximity to the servitude through the modification of habitats and disturbance, particularly during breeding activities.

3.2. PROJECT SPECIFIC ASSESSMENT OF IMPACTS

Specific impacts of the proposed Humansrus Solar 3 SEF are most likely to be manifested in the following ways:

- Disturbance and displacement of local threatened or endemic passerines – Sclater’s Lark, Karoo Long-billed Lark, Large-billed Lark and Ant-eating Chat – and shy ground-nesting species – Burchell’s Courser and Double-banded Courser – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the SEF.
- Disturbance and displacement of resident or visiting large terrestrial species – Kori Bustard, Ludwig’s Bustard, Karoo Korhaan and Secretarybird – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the SEF, and/or mortality of these species in collisions with new power lines whilst flying *en route* to distant resource areas.
- Disturbance and displacement of resident or visiting raptors – Lanner Falcon and Martial Eagle – from foraging areas by construction and/or operation and/or decommissioning of the SEF, and/or mortality of these species in collisions with new power lines or by electrocutions when perched on power infrastructure.
- Injury or mortality of waterbirds birds – Greater Flamingo – using possible flight paths in and out of resource areas in the broader impact zone of the SEF in collisions with solar panels and/or new power lines.

Generally, however, the anticipated impacts on avifauna of the proposed development are not considered to be of any great significance if mitigation measures are applied. There will be some habitat loss for endemic passerines, some species – endemic passerines, large terrestrial species and raptors – may be displaced from a broader area either temporarily by construction and maintenance activities, or more permanently by the disruptive, reflective properties of the solar panels and ongoing activities at the operational development, and some species (large terrestrials, raptors and transient waterbirds birds) may be killed in interactions (collisions and electrocutions) with the new power lines and power infrastructure, but numbers affected are likely to be low.

3.3. SIGNIFICANCE OF IDENTIFIED IMPACTS OF THE HUMANSRUS SOLAR 3 ENERGY FACILITY

3.3.1. Humansrus Solar PV Facility - construction phase impacts

Habitat loss due to construction

Nature				
All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors through site clearance for solar panels, the construction of internal roads and the establishment of auxiliary buildings.				
The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape.				
<i>All priority species could potentially be affected by this impact.</i>				
	Without mitigation		With mitigation	
	Preferred site layout	Alternative site layout	Preferred site layout	Alternative site layout
Extent	Low	Low	Low	Low
Duration	Long-term	Long-term	Long-term	Long-term
Magnitude	Low	Moderate	Minor	Low
Probability	Definite	Definite	Definite	Definite
Significance	Medium	High	Medium	Medium
Status	Negative			
Reversibility	Low (habitat will be lost during construction)			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Partially, due to the space requirements, some land and avian microhabitats will be impacted.			
Mitigation				
<ul style="list-style-type: none"> All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum. Care must be taken in the vicinity of sensitive microhabitats such as the <i>Ephemeral pans</i> habitat unit. Existing roads must be used as much as possible for access during construction. The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint. Provide adequate briefing for site personnel. Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO). The above measures must be covered in a site specific EMPr and controlled by an ECO. 				
Cumulative impacts				
Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the loss of natural habitat within the area.				
Residual impacts				

Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Disturbance during construction

Nature
 All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species, raptors and waterbirds through the noise and movement of construction equipment and personnel.
 It must however be noted, that species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.
All priority species could potentially be affected by this impact.

	Without mitigation		With mitigation	
	Preferred site layout	Alternative site layout	Preferred site layout	Alternative site layout
Extent	Low	Low	Low	Low
Duration	Short-term	Short-term	Short-term	Short-term
Magnitude	Low	Moderate	Minor	Low
Probability	Highly Probable	Highly Probable	Probable	Probable
Significance	Low	Medium	Low	Low
Status	Negative			
Reversibility	Low (species will be disturbed)			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Partially			

Mitigation

- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
- During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
- The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

Cumulative impacts
 Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the disturbance of avifauna within the area.

Residual impacts
 Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

3.3.2. Humansrus Solar PV Facility 3- operational phase impacts

Disturbance during operation

Nature				
All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species, raptors and waterbirds through the noise and movement of maintenance equipment and personnel.				
<i>All priority species could potentially be affected by this impact.</i>				
	Without mitigation		With mitigation	
	Preferred site layout	Alternative site layout	Preferred site layout	Alternative site layout
Extent	Low	Low	Low	Low
Duration	Long-term	Long-term	Long-term	Long-term
Magnitude	Low	Low	Minor	Minor
Probability	Highly Probable	Highly Probable	Probable	Probable
Significance	Medium	Medium	Low	Low
Status	Negative			
Reversibility	Low (species will be disturbed)			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Partially			
Mitigation				
<ul style="list-style-type: none"> • If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling of panels or other problems, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed. • If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation. • Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted. • Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads. 				
Cumulative impacts				
Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the disturbance of avifauna within the area.				
Residual impacts				
Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.				

Collisions with solar panels

Nature
 The PV facility is comprised of reflective panelling occupying a large area. Avifauna can be disorientated by the reflected light and consequently be displaced from an area more extensive than just the development footprint.
 Waterbirds have been known to mistake the reflective surface for an expanse of water and attempt to land on the panels, resulting in injuries and even death.
Large terrestrial species, raptors and waterbirds could potentially be affected by this impact.

	Without mitigation		With mitigation	
	Preferred site layout	Alternative site layout	Preferred site layout	Alternative site layout
Extent	Low	Low	Low	Low
Duration	Long-term	Long-term	Long-term	Long-term
Magnitude	Low	Low	Minor	Minor
Probability	Improbable	Improbable	Improbable	Improbable
Significance	Low	Low	Low	Low
Status	Negative			
Reversibility	Low (birds may be injured or killed)			
Irreplaceable loss of resources	Yes			
Can impacts be mitigated	No			
Mitigation	<ul style="list-style-type: none"> • Monitor all avifaunal incidents or mortalities observed within the facility (recorded and documented with photographs to ensure correct identification). • If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice. 			
Cumulative impacts	Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the area being covered by solar panels thus increasing the probability of collisions.			
Residual impacts	None. Once the solar panels are decommissioned the injuries and mortalities will cease.			

3.3.3. Humansrus Solar 3 PV Facility grid connection - construction phase impacts

Habitat loss due to power line construction

Nature
 All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species, raptors and waterbirds through site clearance for substations and power line infrastructure and servitudes which have to be cleared of excess vegetation at regular intervals in order to allow access to power lines for maintenance and to prevent vegetation from intruding into the legally prescribed clearance gap, minimising the risk of fire.

The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape.

All priority species could potentially be affected by this impact.

	Without mitigation	With mitigation
Extent	Low	Low
Duration	Long-term	Long-term
Magnitude	Minor	Minor
Probability	Definite	Definite
Significance	Medium	Medium
Status (positive or negative)	Negative	
Reversibility	Low (habitat will be lost during construction) and cannot easily be recovered after the development ceases.	
Irreplaceable loss of resources?	No	
Can impacted be mitigated?	Partially, due to the space requirements, some land and avian microhabitat will be impacted.	
Mitigation		
<ul style="list-style-type: none"> • All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum. • Care must be taken in the vicinity of sensitive microhabitats such as the <i>Ephemeral pans</i> habitat unit. • Existing roads must be used as much as possible for access during construction. • The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint. • Provide adequate briefing for site personnel. • Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO). • The above measures must be covered in a site specific EMP and controlled by an ECO. 		
Cumulative impacts		
Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the loss of natural habitat within the area.		
Residual impacts		
Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.		

Avifaunal disturbance due to grid connection construction activities

All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species, raptors and waterbirds through the noise and movement of construction equipment and personnel.

It must however be noted, that species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during both the construction and operational phases.

All priority species could potentially be affected by this impact.

	Without mitigation	With mitigation
Extent	Low	Low
Duration	Short-term	Short-term
Magnitude	Low	Minor
Probability	Highly Probable	Probable
Significance	Low	Low
Status (positive or negative)	Negative	
Reversibility	Low (species will be disturbed during construction, but disturbance during operational will be lower along the power line.)	
Irreplaceable loss of resources?	No	
Can impacted be mitigated?	Partially	
Mitigation		
<ul style="list-style-type: none"> • Strict control must be maintained over all activities during construction, in line with an approved construction EMPr. • During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified. • The construction camps and laydown areas and site offices etc. must be as close to the site as possible. • Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted. • Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads. 		
Cumulative impacts		
Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the disturbance of avifauna within the area.		
Residual impacts		
Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.		

3.3.4. Humansrus Solar 3 PV Facility grid connection - operational phase impacts

Disturbance along power line

All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species, raptors and waterbirds through the noise and movement of maintenance equipment and personnel.

All priority species could potentially be affected by this impact.

	Without mitigation	With mitigation
Extent	Low	Low
Duration	Short-term	Short-term
Magnitude	Low	Minor
Probability	Highly Probable	Probable
Significance	Low	Low

Status (positive or negative)	Negative
Reversibility	High (species will be disturbed while there is activity along the line, but disturbance will be low at other times and there will not be a long-term impact after decommissioning).
Irreplaceable loss of resources?	No
Can impacted be mitigated?	Partially
Mitigation <ul style="list-style-type: none"> • If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling or panels or other problem, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed. • If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation. • Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted. • Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads. 	
Cumulative impacts Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the disturbance of avifauna within the area.	
Residual risks Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.	

Avian electrocutions on power infrastructure

Electrocutions of birds on associated power infrastructure results in injuries or death and could potentially affect large, perching species in the area such as raptors and storks. Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.*, 2007). *Of the priority species, Martial Eagle and, to a lesser extent, Verreaux's Eagle could potentially be affected by this impact.*

	Without mitigation	With mitigation
Extent	Low	Low
Duration	Long-term	Long-term
Magnitude	Minor	Minor
Probability	Highly Probable	Probable
Significance	Medium	Low
Status (positive or negative)	Negative	
Reversibility	Low (birds will be injured or killed while the power line is	

	present and the impact will only be removed when the)
Irreplaceable loss of resources?	Yes
Can impacted be mitigated?	Yes
Mitigation <ul style="list-style-type: none"> • A “Bird Friendly” structure, with a bird perch (as per standard Eskom guidelines) should be used for the tower infrastructure. • All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002). • Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen <i>et al.</i>, 2012). 	
Cumulative impacts Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.	
Residual impacts Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.	

Avian collisions with power lines

<p>Collisions are the single biggest threat posed by power lines in South Africa (van Rooyen, 2004). Avian species most susceptible and impacted upon are large, heavy-bodied birds such as bustards, storks, korhaans and certain raptors. <i>All priority species could potentially be affected by this impact, but specifically, Kori Bustard, Karoo Korhaan, Secretarybird, Martial Eagle and Greater Flamingo.</i></p>		
	Without mitigation	With mitigation
Extent	Low	Low
Duration	Long-term	Long-term
Magnitude	Low	Minor
Probability	Highly Probable	Probable
Significance	Medium	Low
Status (positive or negative)	Negative	
Reversibility	Low (birds will be injured or killed and the impact will likely persist for the lifetime of the line and will only be reversed when it is removed)	
Irreplaceable loss of resources?	No	
Can impacted be mitigated?	Yes	
Mitigation <ul style="list-style-type: none"> • High sensitivity sections of the power line should be marked with Bird Flight Diverters (BFDs), on the earth wire of the line, 5 metres apart, alternating black and white to increase the visibility of the power line and reduce the likelihood of collisions. • The power line route should be scanned at least twice a month for the first year after 		

construction to identify and locations of high impact. All mortalities along the power line route should be recorded and if there are any sites where repeated mortalities have occurred, an avifaunal specialist should be consulted for advice on additional mitigation measures to be implemented.

Cumulative impacts

Moderate. The development borders the proposed Humansrus Solar 4 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.

Residual impacts

Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.

3.4. COMPARISON OF SITE ALTERNATIVES

One of the main objectives of the avifaunal impact study is to provide a preferred development site for the proposed Humansrus Solar 3 SEF. The following is a description of the site layout options in terms of their avian sensitivity.

Preferred site layout

The preferred site layout falls entirely within a *Medium* sensitivity area, associated with the *Karoo grassland/shrubland* habitat unit. This layout option avoids the *Very High* sensitivity *Ephemeral pans* and is smaller in extent (approximately 220 ha) than the alternative site layout (approximately 240 ha). Bird species diversity and abundance was relatively low and as such, in terms of the potential impacts to avifauna, is considered to have acceptable levels of impact. The preferred site layout is therefore recommended for the Humansrus Solar 3 SEF development.

Alternative site layout

The alternative site layout encompasses a *Very High* sensitivity area, associated with the *Ephemeral pans* habitat unit. Bird species diversity and abundance was high in this habitat unit and as such, any development in this area would have a medium impact to avifauna. The preferred site layout option is therefore recommended over the alternative site layout option for the Humansrus 3 SEF development.

4. CONCLUSION

The study area and more specifically the recommended development area are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were

recorded on-site – Kori Bustard and Karoo Korhaan – the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low.

The proposed Humansrus Solar 3 PV energy facility and its associated power infrastructure has been assessed as having a **medium-low** impact to priority species and general avifauna occurring in the study area and broader impact zone of the development. The development will pose several impacts to avifauna, including: a **low** displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed SEF and its associated power infrastructure; a **low** impact of electrocutions of birds on power infrastructure, with the implementation of mitigation measures; and a **medium** impact of avian collisions with power line infrastructure and solar panels.

Careful and responsible implementation of the required mitigation measures should reduce the construction and operational phase impacts to tolerable and sustainable levels. Every effort should be made to monitor impacts throughout, to learn as much as possible about the effects of SEFs on South African avifauna, and to implement any further mitigation measures in response to ongoing monitoring.

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6. APPENDIX

Appendix 1: Consolidated species list of the proposed Humansrus Solar 3 SEF, including SABAP 1, SABAP 2 and field visit data. Species highlighted in bold are those that were recorded during the field visit.

Common name	Scientific name	Conservation status	Regional endemism	Susceptibility to		
				Collision	Electrocution	Disturbance / habitat loss
Avocet, Pied	<i>Recurvirostra avosetta</i>	-	-	-	-	-
Barbet, Acacia Pied	<i>Tricholaema leucomela</i>	-	Near-endemic	-	-	Moderate
Batis, Pririt	<i>Batis pririt</i>	-	Near-endemic	-	-	Moderate
Bishop, Southern Red	<i>Euplectes orix</i>	-	-	-	-	Moderate
Bokmakierie	<i>Telophorus zeylonus</i>	-	Near-endemic	-	-	Moderate
Brubru	<i>Nilaus afer</i>	-	-	-	-	Moderate
Bulbul, African Red-eyed	<i>Pycnonotus capensis</i>	-	Near-endemic	-	-	Moderate
Bunting, Cape	<i>Emberiza capensis</i>	-	Near-endemic	-	-	Moderate
Bunting, Lark-like	<i>Emberiza impetuani</i>	-	Near-endemic	-	-	Moderate
Bustard, Kori	<i>Ardeotis kori</i>	Near-threatened	-	High	-	Moderate
Bustard, Ludwig's	<i>Neotis ludwigii</i>	Endangered	Endemic	High	-	High
Buzzard, Steppe	<i>Buteo vulpinus</i>	-	-	Moderate	High	-
Canary, Black-throated	<i>Crithagra atrogularis</i>	-	-	-	-	Moderate
Canary, White-throated	<i>Crithagra albogularis</i>	-	Near-endemic	-	-	Moderate
Canary, Yellow	<i>Crithagra flaviventris</i>	-	Near-endemic	-	-	Moderate
Chat, Ant-eating	<i>Myrmecocichla formicivora</i>	-	Endemic	-	-	Moderate
Chat, Familiar	<i>Cercomela familiaris</i>	-	-	-	-	-
Chat, Karoo	<i>Cercomela schlegelii</i>	-	Near-endemic	-	-	Moderate

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Chat, Sickle-winged	<i>Cercomela sinuata</i>	-	Endemic	-	-	Moderate
Chat, Tractrac	<i>Cercomela tractrac</i>	-	Near-endemic	-	-	Moderate
Cisticola, Desert	<i>Cisticola aridulus</i>	-	-	-	-	Moderate
Cisticola, Grey-backed	<i>Cisticola subruficapilla</i>	-	Near-endemic	-	-	Moderate
Cisticola, Levillant's	<i>Cisticola tinniens</i>	-	-	-	-	-
Coot, Red-knobbed	<i>Fulica cristata</i>	-	-	-	-	-
Cursorer, Burchell's	<i>Cursorius rufus</i>	Vulnerable	Near-endemic	-	-	Moderate
Cursorer, Double-banded	<i>Rhinoptilus africanus</i>	-	-	-	-	Moderate
Crombec, Long-billed	<i>Sylvietta rufescens</i>	-	-	-	-	Moderate
Crow, Cape	<i>Corvus capensis</i>	-	-	-	-	-
Crow, Pied	<i>Corvus albus</i>	-	-	Moderate	Moderate	-
Cuckoo, Diederick	<i>Chrysococcyx caprius</i>	-	-	-	-	Moderate
Dove, Cape Turtle	<i>Streptopelia capicola</i>	-	-	-	-	-
Dove, Laughing	<i>Spilopelia senegalensis</i>	-	-	-	-	-
Dove, Namaqua	<i>Oena capensis</i>	-	-	-	-	Moderate
Dove, Rock	<i>Columba livia</i>	-	-	-	-	Moderate
Duck, Yellow-billed	<i>Anas undulata</i>	-	-	Moderate	-	-
Eagle, Martial	<i>Polemaetus bellicosus</i>	Endangered	-	High	High	Moderate
Eagle, Verreaux's	<i>Aquila verreauxii</i>	Vulnerable	-	Moderate	High	Moderate
Eagle-Owl, Spotted	<i>Bubo africanus</i>	-	-	-	High	Moderate
Egret, Western Cattle	<i>Bubulcus ibis</i>	-	-	-	-	-
Eremomela, Yellow-bellied	<i>Eremomela icteropygialis</i>	-	-	-	-	Moderate
Falcon, Lanner	<i>Falco biarmicus</i>	Vulnerable	-	High	Moderate	-
Falcon, Pygmy	<i>Polihierax semitorquatus</i>	-	-	-	-	Moderate
Finch, Red-headed	<i>Amadina erythrocephala</i>	-	Near-endemic	-	-	Moderate
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>	-	Near-endemic	-	-	Moderate
Fiscal, Common	<i>Lanius collaris</i>	-	-	-	-	-
Flamingo, Greater	<i>Phoenicopterus ruber</i>	Near-	-	High	-	-

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		threatened				
Flycatcher, Chat	<i>Bradornis infuscatus</i>	-	Near-endemic	-	-	Moderate
Flycatcher, Fairy	<i>Stenostira scita</i>	-	Endemic	-	-	Moderate
Flycatcher, Fiscal	<i>Sigelus silens</i>	-	Near-endemic	-	-	Moderate
Goose, Egyptian	<i>Alopochen aegyptiaca</i>	-	-	High	High	-
Goshawk, Southern Pale Chanting	<i>Melierax canorus</i>	-	Near-endemic	-	Moderate	Moderate
Grebe, Black-necked	<i>Podiceps nigricollis</i>	-	-	-	-	-
Grebe, Little	<i>Tachybaptus ruficollis</i>	-	-	-	-	-
Greenshank, Common	<i>Tringa nebularia</i>	-	-	-	-	-
Guineafowl, Helmeted	<i>Numida meleagris</i>	-	-	Moderate	-	-
Harrier, Black	<i>Circus maurus</i>	Near-threatened	-	-	-	Moderate
Heron, Black-headed	<i>Ardea melanocephala</i>	-	-	High	High	Moderate
Hoopoe, African	<i>Upupa africana</i>	-	-	-	-	-
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	-	-	Moderate	-	-
Ibis, Hadedda	<i>Bostrychia hagedash</i>	-	-	Moderate	Moderate	-
Kestrel, Greater	<i>Falco rupicoloides</i>	-	-	-	Moderate	Moderate
Kestrel, Rock	<i>Falco rupicolus</i>	-	-	-	-	Moderate
Korhaan, Karoo	<i>Eupodotis vigorsii</i>	Near-threatened	Endemic	High		High
Korhaan, Northern Black	<i>Afrotis afraoides</i>	-	Endemic	High	-	Moderate
Lapwing, Blacksmith	<i>Vanellus armatus</i>	-	-	-	-	-
Lapwing, Crowned	<i>Vanellus coronatus</i>	-	-	-	-	-
Lark, Eastern Clapper	<i>Mirafrja fasciolata</i>	-	Near-endemic	-	-	Moderate
Lark, Fawn-coloured	<i>Calendulauda semitorquata</i>	-	Near-endemic	-	-	Moderate
Lark, Karoo Long-billed	<i>Certhilauda subcoronata</i>	-	Endemic	-	-	High
Lark, Large-billed	<i>Galerida magnirostris</i>	-	Endemic	-	-	High
Lark, Pink-billed	<i>Spizocorys conirostris</i>	-	Near-endemic	-	-	Moderate

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Lark, Red-capped	<i>Calandrella cinerea</i>	-	-	-	-	High
Lark, Sabota	<i>Calendulauda sabota</i>	-	Near-endemic	-	-	Moderate
Lark, Sclater's	<i>Spizocorys sclateri</i>	Near-threatened	Near-endemic	-	-	High
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>	-	Near-endemic	-	-	High
Lark, Stark's	<i>Spizocorys starki</i>	-	Near-endemic	-	-	High
Martin, Rock	<i>Ptyonoprogne fuligula</i>	-	-	-	-	Moderate
Masked-Weaver, Southern	<i>Ploceus velatus</i>	-	-	-	-	Moderate
Moorhen, Common	<i>Gallinula chloropus</i>	-	-	-	-	-
Mousebird, Red-faced	<i>Urocolius indicus</i>	-	-	-	-	Moderate
Mousebird, White-backed	<i>Colius colius</i>	-	Endemic	-	-	Moderate
Nightjar, Rufous-cheeked	<i>Caprimulgus rufigena</i>	-	-	-	-	Moderate
Ostrich, Common	<i>Struthio camelus</i>	-	-	-	-	-
Pigeon, Speckled	<i>Columba guinea</i>	-	-	-	-	-
Pipit, African	<i>Anthus cinnamomeus</i>	-	-	-	-	Moderate
Pipit, Buffy	<i>Anthus vaalensis</i>	-	-	-	-	Moderate
Plover, Kittlitz's	<i>Charadrius pecuarius</i>	-	-	-	-	-
Plover, Three-banded	<i>Charadrius tricollaris</i>	-	-	-	-	-
Prinia, Black-chested	<i>Prinia flavicans</i>	-	Near-endemic	-	-	Moderate
Quail, Common	<i>Coturnix coturnix</i>	-	-	-	-	-
Quelea, Red-billed	<i>Quelea quelea</i>	-	-	-	-	-
Robin-chat, Cape	<i>Cossypha caffra</i>	-	-	-	-	-
Ruff	<i>Philomachus pugnax</i>	-	-	-	-	-
Sandgrouse, Namaqua	<i>Pterocles namaqua</i>	-	Near-endemic	-	-	Moderate
Sandpiper, Common	<i>Actitis hypoleucos</i>	-	-	-	-	-
Sandpiper, Wood	<i>Tringa glareola</i>	-	-	-	-	-
Scrub-Robin, Kalahari	<i>Erythropygia paena</i>	-	Near-endemic	-	-	Moderate
Scrub-Robin, Karoo	<i>Erythropygia coryphaeus</i>	-	-	-	-	Moderate
Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable	-	High	-	Moderate
Shelduck, South African	<i>Tadorna cana</i>	-	Endemic	Moderate	-	-

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Shrike, Lesser Grey	<i>Lanius minor</i>	-	-	-	-	-
Shrike, Red-backed	<i>Lanius collurio</i>	-	-	-	-	-
Snake-Eagle, Black-chested	<i>Circaetus pectoralis</i>	-	-	Moderate	Moderate	Moderate
Sparrow, Cape	<i>Passer melanurus</i>	-	Near-endemic	-	-	-
Sparrow, House	<i>Passer domesticus</i>	-	-	-	-	-
Sparrowlark, Black-eared	<i>Eremopterix australis</i>	-	Endemic	-	-	Moderate
Sparrowlark, Grey-backed	<i>Eremopterix verticalis</i>	-	Near-endemic	-	-	Moderate
Sparrow-Weaver, White-browed	<i>Plocepasser mahali</i>	-	-	-	-	Moderate
Starling, Pied	<i>Lamprotornis bicolor</i>	-	Endemic	-	-	Moderate
Starling, Wattled	<i>Creatophora cinerea</i>	-	-	-	-	-
Stilt, Black-winged	<i>Himantopus himantopus</i>	-	-	-	-	-
Stonechat, African	<i>Saxicola torquatus</i>	-	-	-	-	Moderate
Stork, White	<i>Ciconia ciconia</i>	-	-	Moderate	Moderate	-
Sunbird, Dusky	<i>Cinnyris fuscus</i>	-	Near-endemic	-	-	Moderate
Swallow, Barn	<i>Hirundo rustica</i>	-	-	-	-	Moderate
Swallow, Greater-striped	<i>Cecropis cucullata</i>	-	-	-	-	Moderate
Swallow, White-throated	<i>Hirundo albigularis</i>	-	-	-	-	Moderate
Swift, Common	<i>Apus apus</i>	-	-	-	-	-
Swift, Little	<i>Apus affinis</i>	-	-	-	-	-
Swift, White-rumped	<i>Apus caffer</i>	-	-	-	-	-
Teal, Cape	<i>Anas capensis</i>	-	-	Moderate	-	-
Teal, Hottentot	<i>Anas hottentota</i>	-	-	-	-	-
Teal, Red-billed	<i>Anas erythrorhyncha</i>	-	-	-	-	-
Thick-knee, Spotted	<i>Burhinus capensis</i>	-	-	Moderate	-	Moderate
Thrush, Karoo	<i>Turdus smithii</i>	-	Endemic	-	-	-
Tit, Ashy	<i>Parus cinerascens</i>	-	-	-	-	Moderate
Tit, Cape Penduline-	<i>Anthoscopus minutus</i>	-	Near-endemic	-	-	Moderate
Tit-Babbler, Chestnut-vented	<i>Sylvia subcaerulea</i>	-	Near-endemic	-	-	Moderate
Tit-Babbler, Layard's	<i>Sylvia layardi</i>	-	Endemic	-	-	Moderate
Wagtail, Cape	<i>Motacilla capensis</i>	-	-	-	-	-

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Warbler, African Reed	<i>Acrocephalus baeticatus</i>	-	-	-	-	-
Warbler, Lesser Swamp	<i>Acrocephalus gracilirostris</i>	-	-	-	-	-
Warbler, Rufous-eared	<i>Malcorus pectoralis</i>	-	Endemic	-	-	Moderate
Waxbill, Common	<i>Estrilda astrild</i>	-	-	-	-	Moderate
Weaver, Cape	<i>Ploceus capensis</i>	-	Endemic	-	-	Moderate
Weaver, Sociable	<i>Philetairus socius</i>	-	Endemic	-	-	Moderate
Wheatear, Capped	<i>Oenanthe pileata</i>	-	-	-	-	Moderate
Wheatear, Mountain	<i>Oenanthe monticola</i>	-	Near-endemic	-	-	Moderate
Whimbrel	<i>Numenius phaeopus</i>	-	-	-	-	-
White-eye, Cape	<i>Zosterops capensis</i>	-	Endemic	-	-	Moderate