KLIPGATS PAN PHOTOVOLTAIC ENERGY FACILITY

Avian impact assessment

AVISENSE CONSULTING

CONTENTS

1. EXECUTIVE SUMMARY

This study contains a review of the relevant literature on the impacts on avifauna of solar energy facilities and their associated electrical infrastructure, and identifies potential impacts of the proposed Klipgats Pan Photovoltaic (PV) Energy Facility on the avifauna of the Copperton area. The proposed facility is located near to, and on the same farm, as an approved 10 MW facility which is also proposed by the same applicant. The expected impacts are: habitat destruction by the construction of the facility itself and its associated power lines or substation/s, disturbance by construction and maintenance activities and possibly by the operation of the facility, and possible displacement or disturbance of sensitive species, and mortality caused by collision with the associated power line network, and electrocution of avifauna on the required power line and substation infrastructure. In addition, some birds may interfere with the efficient running of the proposed PV installation.

The broader impact zone of the proposed PV facility is contained within an extensive tract of undulating, remote, arid Bushmanland Karoo, while the immediate vicinity probably features degraded natural veld with some anthropogenic influences. The area could support over 200 bird species, including up to 18 red-listed species, 68 endemics, and five red-listed endemics. The birds of greatest potential relevance and importance in terms of the possible impacts of the PV facility are likely to be local populations of endemic, and possibly red-listed passerines (including Sclater's Lark *Spizocorys sclateri* and possibly Red Lark *Calendulauda burra*), locally resident or passing raptors, especially red-listed species - Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax* and Lanner Falcon *Falco biarmicus*, seasonal influxes of Ludwig's Bustard *Neotis ludwigii* and Kori Bustard *Ardeotis kori*,, and possibly over-flights of commuting wetland birds, especially flamingos. Pigeons, crows, weavers, sparrows and some raptor species may perch, roost, forage or even nest on or around the facility and cause fouling problems.

Given the homogeneity of the contained and surrounding habitat, and the relatively small footprint of 100 MW PV plant (in either of the proposed locations), it is deemed unlikely to have any significant, long-term impact on the local avifauna. A comprehensive programme is put forward to fully monitor and research the actual impacts of the PV Facility on the broader avifauna of the area, from pre-construction and into the operational phase of the development.

2. INTRODUCTION

Mulilo Renewable Energy (Pty) Ltd is planning to construct a 100 MW Photovoltaic Power Generation Facility (project name 'Klipgats Pan Photovoltaic Energy Facility') on portions of the farm Klipgats Pan 117, near the old mining settlement of Copperton, about 55 km southwest of Prieska, Northern Cape Province, South Africa. Aurecon South Africa (Pty) Ltd were appointed to do the Environmental Impact Assessment (EIA) study, and subsequently appointed Andrew Jenkins (*AVISENSE* Consulting cc) to conduct the specialist avifaunal assessment. Dr Jenkins is an experienced ornithologist, with over 20 years experience in avian research and impact assessment work. He has been involved in many power line, and wind and solar farm EIA and EMP studies in South Africa, and also does research on raptors, bustards and cranes in various parts of the country.

3. DECLARATION OF INDEPENDENCE

Andrew Jenkins (*AVISENSE* Consulting cc) is an independent consultant to Aurecon South Africa (Pty) Ltd and Mulilo Renewable Energy (Pty) Ltd. He has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist in performing such work (also see Annexure 1 below).

4. TERMS OF REFERENCE

The terms of reference for the full EIA, as supplied by Aurecon, were to:

- Review the latest literature on bird-solar power interactions as a desk-top exercise.
- Undertake the requisite field work to directly assess the habitats present within the inclusive impact zone, and to determine the in situ avifauna and identify any bird flight corridors present in the area.
- Integrate the on-site information with bird atlas (Southern African Bird Atlas Project - SABAP - 1 & 2) and any other relevant data available for the general area, to develop and inclusive, annotated list of the birds likely to occur on the site.
- Highlight Red Data species, endemic, restricted-range or other species of particular concern that may occur in the study area.
- Identify, describe and assess potential direct and indirect and cumulative impacts resulting from the proposed development both on the footprint and the immediate surrounding area during construction and operation.
- Recommend mitigation measures to reduce or eliminate potential negative impacts on avifauna, and improve positive impacts.

5. LIMITATIONS AND ASSUMPTIONS

Any inaccuracies or deficiencies in the primary sources of information used in the compilation of this report could limit its value. The SABAP1 data (see below) for the Copperton area are now >15 years old (Harrison *et al.* 1997), and comprise only eight bird atlas cards for the relevant quarter-degree square, while there is presently only two SABAP 2 atlas card for the relevant pentad. No more reliable and/or more recent formal data on bird species presence and abundance in the study area currently exist.

The site visit (conducted on January 7 2012), in combination with previous visits to the immediate area for EIA work on neighbouring renewable energy projects (Jenkins 2010, 2011), goes some way towards remedying this knowledge deficiency. However, with limited time in the field, and no seasonal spread, it is possible that important components of the local avifauna – nest sites, localized areas of key habitat for rare or threatened species – were missed.

Given that there are currently no solar energy facilities operative in South Africa, there are no existing data on the environmental effects of these installations in this country.

6. STUDY METHODOLOGY

6.1 Approach

The study included the following steps:

- A review was done of available published and unpublished literature pertaining to bird interactions with solar energy facilities and associated power infrastructure (see above), summarizing the issues involved and the current level of knowledge in this field. Various information sources (listed below), including data on the birdlife of the area and previous studies of bird interactions with solar energy facilities and electricity infrastructure, were examined.
- An inclusive, annotated list of the avifauna likely to occur within the impact zone of the proposed PV Facility was compiled using a combination of the existing distributional data and previous experience of the avifauna of the general area.
- A short-list of priority bird species (defined in terms of conservation status and endemism) which could be impacted by the proposed PV facility was extracted from the total bird list. These species were subsequently considered as adequate surrogates for the local avifauna in general, and mitigation of impacts on these species was considered likely to accommodate any less important bird populations that may also potentially be affected.
- A matrix of possible impacts on the local avifauna was drawn up for the proposed PV facility, and the significance of these impacts was assessed in terms of the available suite of mitigation options.

6.2 Data sources used

The following data sources and reports were used in the compilation of this report:

- Bird distribution data of the SABAP (Harrison *et al.* 1997) were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the SABAP 1 quarter-degree squares covering the proposed PV facility and its associated infrastructure (3022AB Springbokpoortjie), and for the relevant SABAP 2 pentad (3000_2215). A composite list of species likely to occur in the impact zone of the PV facility was drawn up as a combination of these data, refined by a more specific assessment of the actual habitats affected, based on general knowledge of the birds of the region (Appendix 1).
- The conservation status and endemism of all species considered likely to occur in the area was determined from the national Red-list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- Information on large raptors resident on the nearby Aries-Kronos and Kronos-Hydra 400 kV transmission lines from the Eskom Electric Eagle Project (Jenkins *et al.* 2007), and recent information on large bird collision rates on the same lines (Jenkins *et al.* 2011).

7. OVERVIEW OF PROPOSAL

The proposed Klipgats Pan PV Energy Facility will be located on the farm Klipgats Pan 117, Copperton (Fig. 1), and will employ an array of PV plates extending over an area of about 300 ha with a generation capacity of 100 MW (an alternative layout of the same size is also proposed). Some of the existing network of degraded gravel tracks within the development site may be upgraded, and some additional service roadways will be built to access the array. Power generated by the facility will be routed directly into the Eskom Kronos substation by means of a short length of 132 kV power line (Fig. 1).

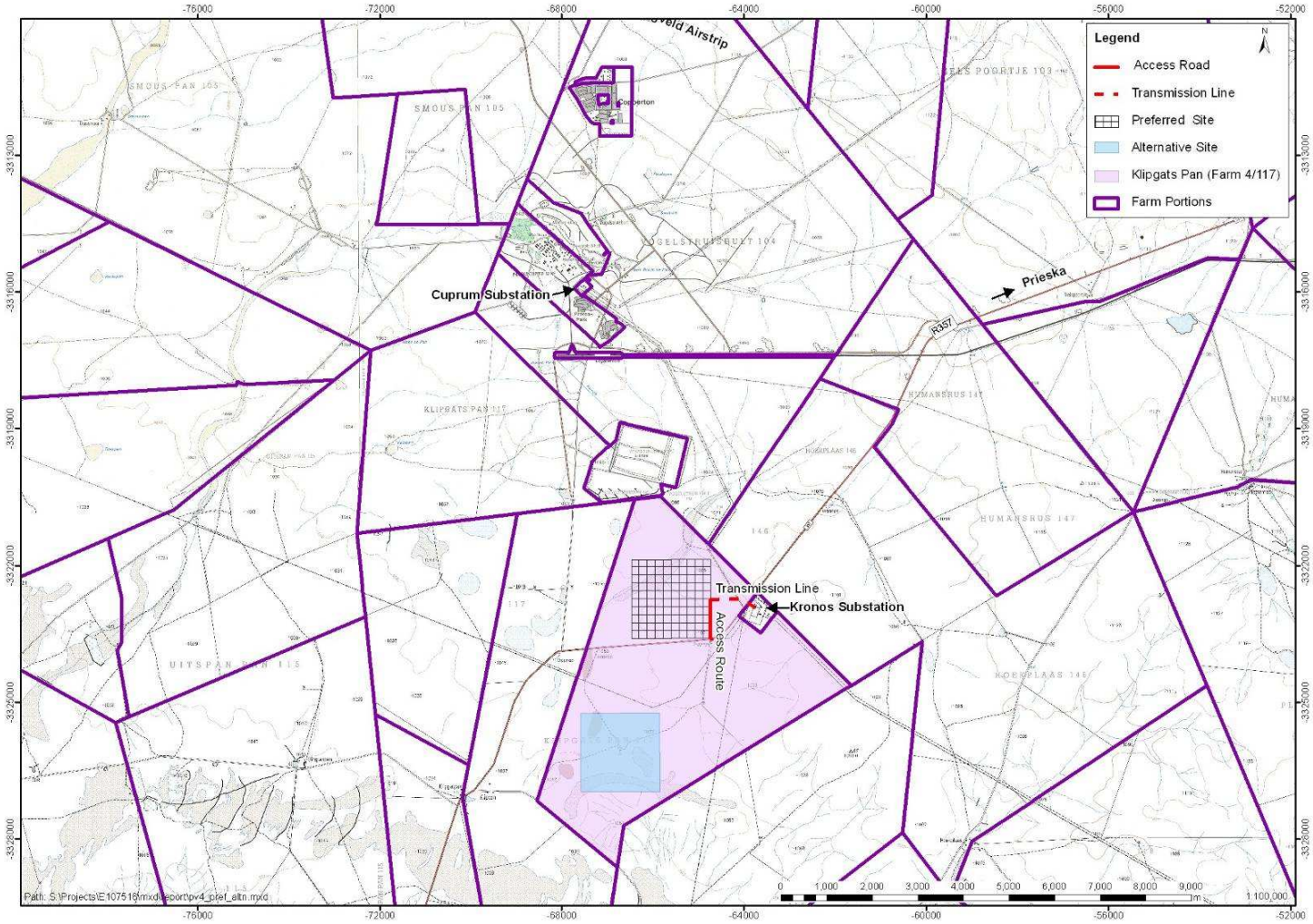

Figure1. The preferred location and layout of the 100 MW Klipgats Pan PV Energy Facility, in relation to an alternative site considered for a PV plant of the same size, the entire contracted property, and the Eskom Kronos substation.

8. DESCRIPTION OF THE AFFECTED ENVIRONMENT

8.1 Vegetation of the study area

The study area is located in the Bushmanland Bioregion of the Nama Karoo Biome (Mucina & Rutherford 2006). The natural vegetation of the study area is dominated by Bushmanland Basin Shrubland – irregular plains with dwarf shrubland, with low, drought resistant shrubs and grassland, and sporadic, rain-driven outbreaks of annuals (Mucina & Rutherford 2006).

8.2 Avian microhabitats

These largely comprise degraded areas of natural Karoo veld, with taller vegetation and trees along drainage lines, areas of exposed rock, road cuttings or borrow-pits, and possibly one or two small artificial and/or ephemeral waterbodies. The broader area features vast expanses of remote but probably heavily grazed stock and game ranchland, with the Doringberg range and the Orange River valley system some 40-50 km away to the northeast. The proposed development area is situated about 6 km south of the new disused Copperton copper mine. The R357 roadway runs just to the south of the study area, and the small settlement of Copperton lies about 9 km to the north.

8.3 Avifauna of the impact area

At least 215 bird species are considered likely to occur with some regularity within the anticipated impact zone of the PV facility (Appendix 1), including 68 endemic or near-endemic species, 18 red-listed species, and five species – Ludwig's Bustard *Neotis ludwigii*, Blue Crane *Anthropoides paradiseus*, Black Harrier *Circus maurus*, Red Lark *Calendulauda burra* and Sclater's Lark *Spizocorys sclateri* – which are both endemic and red-listed (Barnes 1998, 2000, Table 1).

The birds of greatest potential relevance and importance in terms of the possible impacts of the PV facility are likely to be local populations of endemic, and possibly red-listed passerines (Sclater's Lark and possibly Red Lark), seasonal influxes of Ludwig's Bustard and Kori Bustard *Ardeotis kori*, and locally resident or passing raptors, especially red-listed species - Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax* and Lanner Falcon *Falco biarmicus*, all of which breed on the nearby Eskom transmission lines (Jenkins *et al.* 2007), and regional endemics such as Jackal Buzzard *Buteo rufofuscus* and Pale Chanting Goshawk *Melierax canorus*. The birds most likely to proliferate and become active around the facility, possibly causing fowling problems, could include Speckled Pigeon *Columba guinea*, Greater Kestrel *Falco rupicolus*, Pale Chanting Goshawk, Cape Crow *Corvus capensis*, Pied Crow *Corvus albus*, Cape Sparrow *Passer melanurus*, House Sparrow *Passer domesticus* and Sociable Weaver *Philetairus socius*, and possibly variety of other perch-hunting hunting and insectivorous passerines. Note: the site is on the southern edge of a recent range expansion by Sociable Weaver *Philetarius socius*, The huge communal grass nests built by this species may require active management if any are attached to critical infrastructure of the development.

Table 1. Priority bird species considered central to the avian impact assessment process for the proposed Klipgats Pan PV Energy Facility, selected mainly on the basis of South African (Barnes 2000) or global conservation status (www.iucnredlist.org or http://www.birdlife.org/datazone/species/), level of endemism, relative abundance on site (SABAP reporting rates, direct observation), and estimated conservation or ecological significance of the local population. Red-listed endemic species are shaded in grey.

Common name	Scientific name	SA conservation status/ (Global conservation status)	Regional endemism	Average reporting rate[1] (*n* = 10 cards)	Estimated importance of local population	Preferred habitat	Risk posed by		
							Collision	Electro-cution	Disturbance / habitat loss
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable (Endangered)	Near-endemic	20.0	Moderate-High	Open Karoo	High	-	Moderate
Kori Bustard	*Ardeotis kori*	Vulnerable	-	0.0	Moderate	Open Karoo	High	-	Moderate
Tawny Eagle	*Aquila rapax*	Vulnerable	-	0.0	Low				
Martial Eagle	*Polemaetus bellicosus*	Vulnerable (Near-threatened)	-	0.0	Moderate-High	Open Karoo, power pylons	High	High	Moderate
Secretarybird	*Sagittarius serpentarius*	Near-threatened (Vulnerable)	-	0.0	Moderate	Open Karoo	High	-	Moderate
Lanner Falcon	*Falco biarmicus*	Near-threatened	-	0.0	Moderate	Open Karoo, power pylons	High	Moderate	-
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-	0.0	Low	Wetlands, flying over	High	-	-
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-	0.0	Low	Wetlands, flying over	High	-	-
Red Lark	*Calendulauda burra*	Vulnerable (Vulnerable)	Endemic	0.0	Low	Open Karoo	-	-	Moderate
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Endemic	30.0	Moderate	Open Karoo	-	-	Moderate

[1] Reporting rate calculated as the % of bird lists submitted for a given area which include each species.

Surveys of large raptors nesting on the steel pylons supporting Eskom's transmission lines in the area place regularly active Martial Eagle nests within about 3-4 km east of the proposed development area, on tower 512 of the Hydra-Kronos 400 kV line, and within about 18 km to the west, on tower 392 of the Aries-Kronos 400 kV line (Jenkins *et al.* 2007).

Greater Kestrels have been found breeding in Pied Crow *Corvus alba* nests on 132 kV power poles, and Southern Pale Chanting Goshawk *Melierax canorus* nests have been found in trees along drainage lines within/close to the proposed development area (Jenkins 2011). An adult Martial Eagle was seen perched on the 132 kV power poles just outside the development area on January 7 2012. Densities of regional endemics such as Northern Black Korhaan *Afrotis afraoides*, Karoo Korhaan *Eupodotis vigorsii*, Sabota Lark *Calendulauda sabota*, Eastern Clapper Lark *Mirafra fasciolata*, Spike-heeled Lark *Chersomanes albofasciata* and Rufous-eared Warbler *Malcorus pectoralis* may be particularly high in the area, and at least one Ludwig's Bustard *Neotis ludwigii* collision victim has been found under a 132 kV power line in the vicinity (Jenkins 2011).

On the basis of these observations, in combination with already documented information on the avifauna of the general area, ten priority species are recognized as key in the assessment of avian impacts of the proposed Klipgats Pan PV Energy Facility (Table 1). These are mostly nationally and/or globally threatened species which are known to occur, or could occur, in relatively high numbers in the development area and which are likely to be, or could be, negatively affected by the PV solar power plant project. Eight species were included despite the fact that they were not recorded in either SABAP 1 or SABAP 2 data for the area, either because (a) they were seen on site, (b) the site is located within their respective distributions and the available habitat is possibly suitable, or (c) they may occasionally fly over the site *en route* between distant resource areas, and in so doing be exposed possible impacts.

Overall, the avifauna of the development site itself is entirely replaceable, at best replicating that which occurs across huge areas of Bushmanland. Given the nomadic nature and huge space requirements of birds in this semi-arid environment, and given that the area directly affected by the proposed development is relatively small and homogeneous in nature, it is unlikely to support any significant populations of any priority species.

9. ASSESSMENT OF IMPACTS

9.1 General assessment of impacts & mitigation

9.1.1 Impacts of solar energy facilities

Habitat loss – destruction, disturbance and displacement

Perhaps the most significant potential impact on birds of any solar energy generation facility is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. Given the considerable space requirements of commercially viable facilities (>50-100 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.

To a lesser extent, construction and ongoing maintenance activities are likely to cause some disturbance of birds in the general surrounds of a solar facility, and especially of shy and/or ground-nesting species resident in the area. Mitigation of such effects requires that generic best-practice principles be rigorously applied - sites are selected to avoid the destruction of key habitats, and construction and final footprints, as well as sources of disturbance of key species, must be kept to an absolute minimum.

Other effects

Any vertical, reflective surfaces may confuse approaching birds with the result that numbers are killed in collisions with such surfaces. If this source of unnatural mortality is a realistic expectation of a proposed solar installation, efforts should be made to restrict access by birds into the relevant, hazardous areas of the facility. Solar installations generally feature large areas of reflective paneling. It is possible that nearby or overflying birds may be disorientated by the reflected light, and consequently be displaced from an area more extensive than just the developed footprint of the facility.

Conversely, certain bird species may be attracted to the solar arrays. The possibility also exists that waterbirds will mistake the reflective surface for an expanse of water, and attempt to land on the panels, incurring injury and/or being disorientated in the process. Other 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 (plants growing under the paneling, other animals attracted to the facility). Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with the facility operators. Under these circumstances, specialist advice should be sought in devising effective avian deterrents to minimize associated damage.

9.1.2 Impacts of associated infrastructure

Infrastructure commonly associated with solar energy facilities may also have detrimental effects on birds. The construction and maintenance of substations, power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance, and overhead power lines pose a collision and possibly an electrocution threat to certain species (Van Rooyen 2004a, Lehman *et al.* 2007, Jenkins *et al.* 2010).

Construction and maintenance of power lines and substations

Some habitat destruction and alteration inevitably takes place during the construction of power lines, substations and associated roadways. Also, power line service roads or servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line (e.g. King & Byers 2002).

Collision with power lines

Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species (Bevanger 1994, 1995, 1998, Janss 2000b, Anderson 2001, van Rooyen 2004a, Drewitt & Langston 2008, Jenkins *et al.* 2010). Mitigation of this risk involves the informed selection of low impact alignments for new

power lines relative to movements and concentrations of high risk species, and the use of either static or dynamic marking devices to make the lines, and in particular the earthwires, more conspicuous. While various marking devices have been used globally, many remain largely untested in terms of their efficacy in reducing collision incidence, and those that have been fully assessed have all been found to be only partially effective (Drewitt & Langston 2008, Jenkins *et al.* 2010).

Electrocution on 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 air gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman *et al.* 2007). Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components. Mitigation of electrocution risk involves the use of bird-safe structures (ideally with critical air gaps >2 m), the physical exclusion of birds from high risk areas of live infrastructure, and comprehensive insulation of such areas (van Rooyen 2004b, Lehman *et al.* 2007).

9.2 Project specific impacts

Specific impacts of the proposed Klipgats Pan PV Energy Facility are most likely to be manifested in the following ways (summarised in Table 2):

(i) Disturbance and displacement of resident/breeding Karoo endemics – especially including Sclater's Lark and possibly even Red Lark - by construction and/or operation and/or decommissioning of the facility.

(ii) Disturbance and displacement of resident/breeding raptors (especially Martial Eagle and possibly Lanner Falcon) from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the facility, and /or mortality of these species in collisions with new power lines or by electrocution when perched on power infrastructure.

(iii) Disturbance and displacement of seasonal influxes of large terrestrial birds (especially Ludwig's Bustard and Kori Bustard) from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the facility, and /or mortality of these species in collisions with new power lines while commuting between resource areas.

(iv) Injury or mortality of wetland birds (especially flamingos) using possible flight lines in and out of resource areas in the broader vicinity, in collisions with the PV infrastructure or associated new power lines.

Generally, however, the anticipated impacts on birds of the proposed development are not considered to be of any great significance (Boxes 1.1 – 1.3, Table 3). There will be some habitat loss for Karoo endemic species (although the general area at the site is already somewhat degraded and disturbed by past mining activities), some species (Karoo endemics, large terrestrial species, 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 some species (large terrestrial species, raptors, commuting wetland birds) may be killed in interactions (collisions, electrocutions) with the new power infrastructure, but again, numbers affected are likely to be low.

Table 2. Impact characteristics: Klipgats Pan PV Energy Facility – Birds.

Summary	Construction	Operation	Decommissioning
Project Aspect/ activity	(i) Disturbance/displacement associated with noise and movement of construction equipment and personnel. (ii) Loss of vegetation and avian habitat through site clearance, road upgrade and establishment of the camp, lay-down and assembly areas.	(i) Loss of habitat to space occupied by solar panels and associated infrastructure, and disturbance / displacement associated with routine maintenance work. (ii) Mortality in collisions with solar panels and/or power lines, or by electrocution on new power infrastructure.	(i) Disturbance/displacement associated with noise and movement of decommissioning equipment and personnel.
Impact Type	Direct	Direct	Direct
Receptors Affected	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, esp. Sclater's Lark. (ii) Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, esp. Sclater's Lark.	(iii) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, esp. Sclater's Lark. (i) All birds on site; Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, overflying wetland birds.	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, esp. Sclater's Lark.

Box 1.1. **Pre-mitigation Construction Impact: Klipgats Pan 100 MW PV Energy Facility – Birds**, with all ratings equally applicable to either of the two selected sites. Significance ratings ascribed as per the criteria provided by Aurecon South Africa.

(A) Habitat loss

Nature: All construction activities would result in a **negative direct** impact on the avifauna of the Klipgats Pan site: loss of vegetation and habitat affecting Karoo endemics, raptors and large terrestrial species, through site clearance, road upgrade and establishment of the camp and assembly areas.

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **short-term** as the ecology of the area may be altered beyond the completion of the project.
- **Likelihood –** There is a **high** likelihood that habitat will be lost

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IMPACT SIGNIFICANCE – LOW-MEDIUM

Confidence: Certain

Reversibility: Irreversible

Cumulative impacts: Could be substantially amplified by multiple renewable energy projects in the area, which seems highly likely.

(B) Disturbance

Nature: All construction activities would result in a **negative direct** impact on the avifauna of the Klipgats Pan PV site; disturbance associated with noise and movement of construction equipment and personnel, affecting Karoo endemics, raptors and large terrestrial species.

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration will not extend beyond the **construction period**.
- **Likelihood –** There is a **high** likelihood that habitat will be disturbed.

IMPACT SIGNIFICANCE – LOW-MEDIUM

Confidence: Certain

Reversibility: Reversible

Cumulative impacts: Could be substantially amplified by multiple renewable energy projects in the area, which seems highly likely.

Box 1.2. **Pre-mitigation Operation Impact: Klipgats Pan 100 MW PV Energy Facility – Birds,** with all ratings equally applicable to either of the two selected sites. Significance ratings ascribed as per the criteria provided by Aurecon South Africa.

(A) Habitat loss and disturbance

Nature: Operational activities would result in a **negative direct** impact on the avifauna of the Klipgats Pan PV site; loss of habitat for Karoo endemics, raptors and large terrestrial species, to space occupied by solar panels and associated infrastructure, and disturbance or displacement of these birds by routine maintenance activities.

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **long-term** as the ecology of the area would be affected until the project stops operating and is fully decommissioned.
- **Likelihood –** There is a **high** likelihood that habitat will be lost and some priority species will be disturbed/displaced.

IMPACT SIGNIFICANCE – LOW-MEDIUM
Confidence: Certain
Reversibility: Irreversible
Cumulative impacts: Could be substantially amplified by multiple renewable energy projects in the area, which seems highly likely.

(B) Mortality

Nature: Operational activities would result in a **negative direct** impact on the avifauna of the Klipgats Pan PV site; mortality of raptors, large terrestrials and overflying wetland birds in collisions with solar panels and/or power lines, or by electrocution on new power infrastructure.

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is potentially **regional**.
- **Duration**: The duration would be **long-term** as the ecology of the area would be affected at least until the project stops operating and is fully decommissioned.
- **Likelihood –** There is a **medium** likelihood that some individuals of priority species will be killed.

IMPACT SIGNIFICANCE – MEDIUM
Confidence: Unsure
Reversibility: Irreversible
Cumulative impacts: Could be substantially amplified by multiple renewable energy projects in the area, which seems highly likely.

Box 1.3. **Pre-mitigation Decommissioning Impact: Klipgats Pan 100 MW PV Energy Facility – Birds**, with all ratings equally applicable to either of the two selected sites. Significance ratings ascribed as per the criteria provided by Aurecon South Africa.

(A) Disturbance

Nature: All decommissioning activities would result in a **negative direct** impact on the avifauna of the Klipgats Pan PV site; disturbance associated with noise and movement of decommissioning equipment and personnel, affecting Karoo endemics, raptors and large terrestrial species.

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be the equivalent of the **Construction period**.
- **Likelihood –** There is a **high** likelihood that birds will be disturbed.

IMPACT SIGNIFICANCE – LOW-MEDIUM

Confidence: Certain

Reversibility: Reversible

Cumulative impacts: Could be substantially amplified by multiple renewable energy projects in the area, which seems highly likely.

Table 3. Pre- and Post- Mitigation Significance: Klipgats Pan PV Energy Facility - Birds; The ratings given are equally applicable to the two selected sites. Significance ratings ascribed as per the criteria provided by Aurecon South Africa.

Impact	Pre-mitigation	Residual (post-mitigation)
Construction Phase		
Habitat loss	LOW-MEDIUM	LOW
Disturbance	LOW-MEDIUM	LOW
Operation Phase		
Displacement & disturbance	LOW-MEDIUM	LOW
Mortality	MEDIUM	LOW-MEDIUM
Decommissioning Phase		
Disturbance	LOW-MEDIUM	LOW

10. MITIGATION

Should the proposed PV Facility be approved, mitigation of impacts on birds should focus on:

(i) Minimizing the inclusive construction footprint of the development and abbreviating construction time.
(ii) Minimizing noise and disturbance associated with maintenance activities at the plant once it becomes operational.
(iii) Minimising the length of any new power lines installed and burying lines wherever possible. If lines cannot be buried, ensure that all new lines are marked with bird flight diverters (Jenkins *et al.* 2010) along their entire length, and that all new power line infrastructure is adequately insulated and bird friendly in configuration (Lehman *et al.* 2007). Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line (Jenkins *et al.* 2010). The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.
(iv) Instituting a comprehensive impact monitoring scheme, and using the results of this scheme to inform and refine a dynamic approach to mitigation.

11. CONCLUSION

The proposed PV Facility is likely to have little, if any significant, long-term impact on the avifauna of the area, after mitigation. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to tolerable and sustainable levels, especially if every effort is made to monitor impacts throughout, to learn as much as possible about the effects of solar energy developments on South African avifauna, and to implement mitigation measures suggested as a result of ongoing monitoring.

Note that the anticipated net impacts of this proposed development should ideally be considered in the context of accumulated impacts imposed by at least three other, similar proposed solar projects (and at least two wind energy projects) within a 20 km radius of Copperton (Fig. 2).

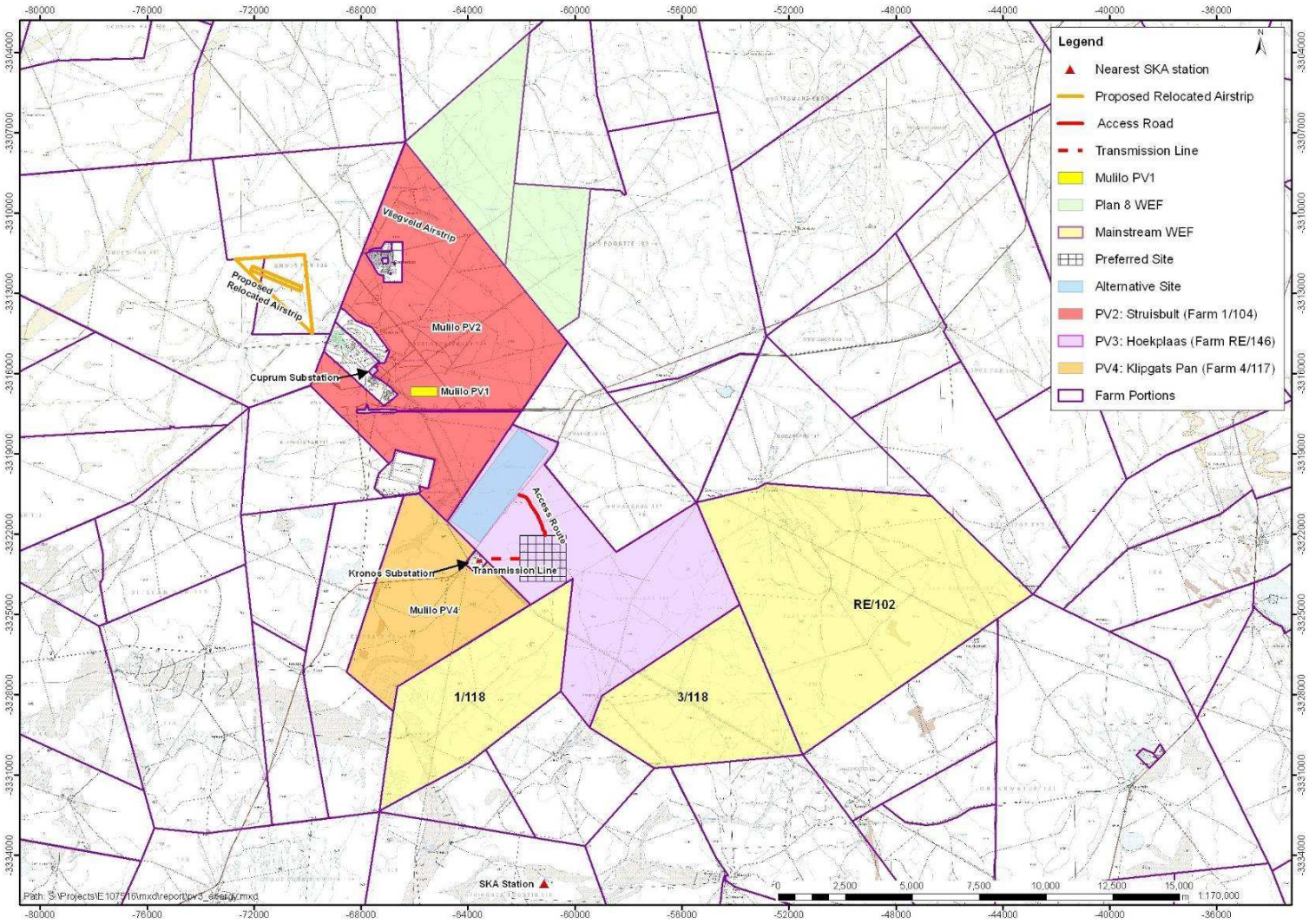

Figure 2. The location of the Klipgats Pan PV Energy Facility (Mulilo PV4) in relation to other renewable energy projects proposed for the Copperton area.

12. LONG-TERM MONITORING

Given that solar energy development is new to South Africa, and its potential impacts on birds are generally not well understood, it is recommended (but not prescribed) that attention be given to improving this understanding by initiating quantitative studies of the avifauna at proposed sites both pre- and post-construction. The primary aims of this monitoring work would be to:

(i) Determine the densities of birds resident within the impact area of the solar power plant before construction of the plant, and afterwards, once the plant, or phases of the plant, become operational.
(ii) Document patterns of bird activity and movements in the vicinity of the proposed solar power plant before construction, and afterwards, once the plant is operational.
(iii) Register and as far as possible document the circumstances surrounding all avian mortalities associated with the solar power plant and its ancillary infrastructure for at least six months after the plant becomes operational.
(iv) Register and as far as possible document the circumstances surrounding all other avian interactions with the solar arrays of the solar power plant for at least six monthsafter the plant becomes operational.

Bird density and activity monitoring should focus on rare and/or endemic, potentially disturbance or collision prone species, which occur with some regularity in the area (see Table 4.1). Ultimately, the study should provide much needed quantitative information on the effects of the solar power plant on the distribution and abundance of birds, and the actual risk it poses to the local avifauna, and serve to inform and improve mitigation measures to reduce this risk. It will also establish a precedent and a template for research and monitoring of avian impacts at possible, future solar power plant sites in the region. Failing the institution of a structured and formalised general monitoring effort (as outlined above and detailed below), at the very least a specialist ornithologist should periodically monitor activities at both of the key raptor nests, immediately preceding, during and after construction.

Monitoring protocols: Avian densities before and after

A set of at least 10 walk-transect routes, each of at least 250 m in length, should be established in areas representative of all the avian habitats present within a 2 km radius of centre of the Klipgats Pan PV site. Each of these should be walked at least once every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the PV plant is commissioned. The transects should be walked after 06h00 and before 09h00, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison.

Monitoring protocols: Bird activity monitoring

Monitoring of bird activity in the vicinity of the solar power plant should be done over a single day at least every two months for the six months preceding construction, and at least once per quarter for a full calendar year starting at least six months after the solar power plant is commissioned. Each monitoring period should involve full-day counts of all species flying over or past the PV plant impact area (see passage rates below).

Monitoring protocols: Bird flight behavior and activities around solar arrays

Counts of bird traffic over and around the proposed/operational solar power plant should be conducted from suitable vantage points (selected and used to provide coverage of avian flights in relation to all areas of the PV plant). Once in position at the selected count station, the observer should record (preferably on a specially designed data sheet) the date, count number, start-time and conditions at start - extent of cloud cover, temperature, wind velocity and visibility – and proceed with the count. The counts should detail all individuals or flocks of the stipulated priority bird species, all raptors, and any additional species of particular interest or conservation concern, seen flying within 200 m of the envisaged or actual periphery of the solar power plant. Each record should include the following data: time, updated weather assessment, species, number, mode of flight (flapping, gliding, soaring), flight activity (commuting, hunting other), direction of flight and, for post construction monitoring, notes on any obvious evasive behaviour or flight path changes observed in response to the solar power plant. The time and weather conditions should again be noted at the end of each count. These observations should also detail (time, species, nature, location, duration) all direct interactions between birds and the solar panels (e.g. perching, hunting, displaying, nest-building).

Monitoring of avian collisions

Collision monitoring should have two components: (i) experimental assessment of search efficiency and scavenging rates of bird carcasses on the site, and (ii) regular searches of the vicinity of the solar power plant for collision casualties.

Monitoring of avian collisions: Assessing search efficiency and scavenging rates

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed (Morrison 2002). To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, some time before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 10. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcassess are scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximize survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate (Osborn *et al.* 2000, Morrison 2002). Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates should be measured twice during the monitoring year, once in winter and once in summer.

Monitoring of collisions: Collision victim surveys

The area within a radius of at least 20 m of each solar panel, the area on and under the panel itself, and the area within 5 m on either side of any new lengths of power line, should be checked regularly for bird casualties (Anderson *et al.* 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the

monitoring period (see above), but they should be done at least weekly for the first two months of the study. All suspected mortality incidents should be comprehensively documented, detailing the apparent cause of death, precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labeled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box, and the local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre. These surveys should also include detailing (location, extent, size, number) of all bird products (e.g. faeces, pellets, nest structures etc) found on the solar panels.

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Appendix 1. Inclusive, annotated list of the bird species considered likely to occur within the broader impact zone of the proposed locations for the Klipgats Pan Energy Facility.

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Common Ostrich	*Struthio camelus*	-	-	X					-	-	High
Orange River Francolin	*Scleroptila levaillantoides*	-	Near-endemic	X	X				Moderate	-	High
Cape Spurfowl	*Pternistis capensis*	-	Endemic		X				Moderate	-	High
Common Quail	*Coturnix coturnix*	-	-	X					-	-	High
Helmeted Guineafowl	*Numida meleagris*	-	-		X				Moderate	-	High
Egyptian Goose	*Alopochen aegyptiaca*	-	-				X		High	High	-
South African Shelduck	*Tadorna cana*	-	Endemic				X		High	-	-
Yellow-billed Duck	*Anas undulata*	-	-				X		Moderate	-	-
Cape Shoveler	*Anas smithii*	-	Endemic				X		Moderate	-	-
Red-billed Teal	*Anas erythrorhyncha*	-	-				X		Moderate	-	-
Kurrichane Buttonquail	*Turnix sylvaticus*	-	-	X					-	-	High

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Lesser Honeyguide	*Indicator minor*	-	-		X				-	-	Moderate
Golden-tailed Woodpecker	*Campethera abingoni*	-	-		X				-	-	Moderate
Cardinal Woodpecker	*Dendropicos fuscescens*	-	-		X				-	-	Moderate
Acacia Pied Barbet	*Tricholaema leucomelas*	-	Near-endemic		X				-	-	Moderate
African Grey Hornbill	*Tockus nasutus*	-	-		X				-	-	Moderate
African Hoopoe	*Upupa africana*	-	-		X				-	-	Moderate
Common Scimitarbill	*Rhinopomastus cyanomelas*	-	-		X				-	-	Moderate
European Roller	*Coracias garrulus*	-	-	X	X				-	-	-
Lilac-breasted Roller	*Coracias caudatus*	-	-		X				-	-	Moderate
Malachite Kingfisher	*Alcedo cristata*	-	-				X		-	-	-
Pied Kingfisher	*Ceryle rudis*	-	-				X		-	-	-
Swallow-tailed Bee-eater	*Merops hirundineus*	-	-	X	X	X	X		-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
European Bee-eater	*Merops apiaster*	-	-						-	-	-
White-backed Mousebird	*Colius colius*	-	Endemic		X				-	-	Moderate
Red-faced Mousebird	*Urocolius indicus*	-	-		X				-	-	Moderate
Jacobin Cuckoo	*Clamator jacobinus*	-	-		X				-	-	Moderate
Diderick Cuckoo	*Chrysococcyx caprius*	-	-		X				-	-	Moderate
Rosy-faced Lovebird	*Agapornis roseicollis*	-	Near-endemic		X				-	-	Moderate
African Palm-Swift	*Cypsiurus parvus*	-	-		X				-	-	-
Alpine Swift	*Tachymarptis melba*	-	-					X	-	-	-
Common Swift	*Apus apus*	-	-					X	-	-	-
Bradfield's Swift	*Apus bradfieldi*	-	Near-endemic			X		X	-	-	-
Little Swift	*Apus affinis*	-	-			X			-	-	-
White-rumped Swift	*Apus caffer*	-	-					X	-	-	-
Barn Owl	*Tyto alba*	-	-	X	X	X			-	Moderate	Moderate
Southern White-faced Scops-Owl	*Ptilopsis granti*	-	-		X				-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Cape Eagle-Owl	*Bubo capensis*	-	-			X			-	High	Moderate
Spotted Eagle-Owl	*Bubo africanus*	-	-	X	X	X			-	High	Moderate
Verreaux's Eagle-Owl	*Bubo lacteus*	-	-		X				-	High	Moderate
Pearl-spotted Owlet	*Glaucidium perlatum*	-	-		X				-	-	Moderate
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	-	-	X					-	-	Moderate
Rock Dove	*Columba livia*	-	-			X		X	-	-	Moderate
Speckled Pigeon	*Columba guinea*	-	-			X		X	-	-	Moderate
Laughing Dove	*Streptopelia senegalensis*	-	-		X				-	-	Moderate
Cape Turtle-Dove	*Streptopelia capicola*	-	-		X				-	-	Moderate
Red-eyed Dove	*Streptopelia semitorquata*	-	-		X				-	-	Moderate
Namaqua Dove	*Oena capensis*	-	-	X	X				-	-	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable	Near-endemic	X					High	-	Moderate
Kori Bustard	*Ardeotis kori*	Vulnerable	-	X					High	-	Moderate
Red-crested Korhaan	*Eupodotis ruficrista*	-	Near-endemic	X					Moderate	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Northern Black Korhaan	*Afrotis afraoides*	-	Endemic	X					Moderate	-	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	-	Endemic	X					Moderate	-	Moderate
Blue Crane	*Anthropoides paradiseus*	Vulnerable	Endemic	X			X		High	-	Moderate
Common Moorhen	*Gallinula chloropus*	-	-				X		-	-	-
Red-knobbed Coot	*Fulica cristata*	-	-				X		-	-	-
Namaqua Sandgrouse	*Pterocles namaqua*	-	Near-endemic	X			X		-	-	-
Double-banded Sandgrouse	*Pterocles bicinctus*	-	-	X			X		-	-	-
Burchell's Sandgrouse	*Pterocles burchelli*	-	Near-endemic	X			X		-	-	-
Marsh Sandpiper	*Tringa stagnatilis*	-	-				X		-	-	-
Common Greenshank	*Tringa nebularia*	-	-				X		-	-	-
Wood Sandpiper	*Tringa glareola*	-	-				X		-	-	-
Common Sandpiper	*Actitis hypoleucos*	-	-				X		-	-	-
Little Stint	*Calidris minuta*	-	-				X		-	-	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Curlew Sandpiper	*Calidris ferruginea*	-	-				X		-	-	-
Ruff	*Philomachus pugnax*	-	-				X		-	-	-
Spotted Thick-knee	*Burhinus capensis*	-	-	X	X				-	-	-
Black-winged Stilt	*Himantopus himantopus*	-	-				X		-	-	-
Pied Avocet	*Recurvirostra avosetta*	-	-				X		-	-	-
Kittlitz's Plover	*Charadrius pecuarius*	-	-				X		-	-	-
Three-banded Plover	*Charadrius tricollaris*	-	-				X		-	-	-
Chestnut-banded Plover	*Charadrius pallidus*	Near-threatened	-				X		-	-	-
Blacksmith Lapwing	*Vanellus armatus*	-	-				X		-	-	-
Crowned Lapwing	*Vanellus coronatus*	-	-	X					-	-	-
Double-banded Courser	*Rhinoptilus africanus*	-	-	X					-	-	-
Burchell's Courser	*Cursorius rufus*	-	Near-endemic	X					-	-	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
White-winged Tern	*Chlidonias leucopterus*	-	-				X		-	-	-
Black-shouldered Kite	*Elanus caeruleus*	-	-	X	X				-	-	Moderate
Black Kite	*Milvus migrans*	-	-	X				X	-	-	-
African Fish-Eagle	*Haliaeetus vocifer*	-	-					X	-	High	-
White-backed Vulture	*Gyps africanus*	Vulnerable	-					X	Moderate	High	Moderate
Lappet-faced Vulture	*Aegypius tracheliotus*	Vulnerable	-					X	Moderate	High	Moderate
Black-chested Snake-Eagle	*Circaetus pectoralis*	-	-					X	-	Moderate	Moderate
Bateleur	*Terathopius ecaudatus*	Vulnerable	-					X	-	Moderate	Moderate
Black Harrier	*Circus maurus*	Near-threatened	Endemic	X			X		-	-	Moderate
African Harrier-Hawk	*Polyboroides typus*	-	-		X			X	-	-	Moderate
Southern Pale Chanting Goshawk	*Melierax canorus*	-	Near-endemic	X	X				-	Moderate	Moderate
Gabar Goshawk	*Melierax gabar*	-	-		X				-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Steppe Buzzard	*Buteo vulpinus*	-	-	X				X	-	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	Endemic	X				X	-	Moderate	Moderate
Tawny Eagle	*Aquila rapax*	Vulnerable	-		X			X	-	High	Moderate
Verreauxs' Eagle	*Aquila verreauxii*	-	-					X	Moderate	High	Moderate
Booted Eagle	*Aquila pennatus*	-	-					X	-	-	Moderate
Martial Eagle	*Polemaetus bellicosus*	Vulnerable	-					X	Moderate	High	Moderate
Secretarybird	*Sagittarius serpentarius*	Near-threatened	-	X				X	High	-	Moderate
Pygmy Falcon	*Polihierax semitorquatus*	-	-	X	X				-	-	Moderate
Rock Kestrel	*Falco rupicolus*	-	-	X		X			-	-	Moderate
Greater Kestrel	*Falco rupicoloides*	-	-	X					-	-	Moderate
Red-necked Falcon	*Falco chicquera*	-	-		X			X		-	Moderate
Red-footed Falcon	*Falco vespertinus*	-	-	X				X	-	-	-
Lanner Falcon	*Falco biarmicus*	Near-threatened	-	X				X	High	Moderate	-
Peregrine Falcon	*Falco peregrinus*	Near-threatened	-	X				X	High	Moderate	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Little Grebe	*Tachybaptus ruficollis*	-	-				X		-	-	-
Black-necked Grebe	*Podiceps nigricollis*	-	-				X		-	-	-
African Darter	*Anhinga rufa*	-	-				X		-	-	-
Reed Cormorant	*Phalacrocorax africanus*	-	-				X		-	-	-
Little Egret	*Egretta garzetta*	-	-				X		-	-	-
Grey Heron	*Ardea cinerea*	-	-				X		Moderate	Moderate	-
Black-headed Heron	*Ardea melanocephala*	-	-	X			X		Moderate	Moderate	-
Cattle Egret	*Bubulcus ibis*	-	-				X		-	-	-
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-					X	High	-	-
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-					X	High	-	-
Hadeda Ibis	*Bostrychia hagedash*	-	-		X			X	Moderate	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	-	-				X	X	Moderate	-	-
African Spoonbill	*Platalea alba*	-	-				X	X	Moderate	-	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Black Stork	*Ciconia nigra*	Near-threatened	-				X	X	High	Moderate	-
Abdim's Stork	*Ciconia abdimii*	-	-				X	X	Moderate	Moderate	-
White Stork	*Ciconia ciconia*	-	-				X	X	High	High	-
Fork-tailed Drongo	*Dicrurus adsimilis*	-	-		X				-	-	Moderate
Brubru	*Nilaus afer*	-	-		X				-	-	Moderate
Crimson-breasted Shrike	*Laniarius atrococcineus*	-	Near-endemic		X				-	-	Moderate
Bokmakierie	*Telophorus zeylonus*	-	Near-endemic		X				-	-	Moderate
Pririt Batis	*Batis pririt*	-	Near-endemic		X				-	-	Moderate
Cape Crow	*Corvus capensis*	-	-	X	X				-	-	Moderate
Pied Crow	*Corvus albus*	-	-	X	X	X			-	-	Moderate
White-necked Raven	*Corvus albicollis*	-	-	X		X			-	-	Moderate
Red-backed Shrike	*Lanius collurio*	-	-	X					-	-	Moderate
Lesser Grey Shrike	*Lanius minor*	-	-	X					-	-	Moderate
Common Fiscal	*Lanius collaris*	-	-	X	X				-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Cape Penduline-Tit	*Anthoscopus minutus*	-	Near-endemic	X					-	-	Moderate
Ashy Tit	*Parus cinerascens*	-	Near-endemic	X					-	-	Moderate
Brown-throated Martin	*Riparia paludicola*	-	-				X	X	-	-	Moderate
Barn Swallow	*Hirundo rustica*	-	-				X	X	-	-	Moderate
White-throated Swallow	*Hirundo albigularis*	-	-				X		-	-	Moderate
Greater Striped Swallow	*Hirundo cucullata*	-	-				X	X	-	-	Moderate
Rock Martin	*Hirundo fuligula*	-	-			X	X	X	-	-	Moderate
African Red-eyed Bulbul	*Pycnonotus nigricans*	-	Near-endemic		X				-	-	Moderate
Fairy Flycatcher	*Stenostira scita*	-	Endemic		X				-	-	Moderate
Long-billed Crombec	*Sylvietta rufescens*	-	-	X	X				-	-	Moderate
Yellow-bellied Eremomela	*Eremomela icteropygialis*	-	-	X	X				-	-	Moderate
African Reed-Warbler	*Acrocephalus baeticatus*	-	-				X		-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Lesser Swamp-Warbler	*Acrocephalus gracilirostris*	-	-				X		-	-	Moderate
Willow Warbler	*Phylloscopus trochilus*	-	-		X				-	-	Moderate
Layard's Tit-Babbler	*Parisoma layardi*	-	Endemic	X	X				-	-	Moderate
Chestnut-vented Tit-Babbler	*Parisoma subcaeruleum*	-	Near-endemic		X				-	-	Moderate
Orange River White-eye	*Zosterops pallidus*	-	Endemic		X				-	-	Moderate
Grey-backed Cisticola	*Cisticola subruficapilla*	-	Near-endemic	X	X				-	-	Moderate
Levaillant's Cisticola	*Cisticola tinniens*	-	-				X		-	-	Moderate
Zitting Cisticola	*Cisticola juncidis*	-	-				X		-	-	Moderate
Desert Cisticola	*Cisticola aridulus*	-	-				X		-	-	Moderate
Black-chested Prinia	*Prinia flavicans*	-	-		X				-	-	Moderate
Karoo Prinia	*Prinia maculosa*	-	Endemic	X	X				-	-	Moderate
Namaqua Warbler	*Phragmacia substriata*	-	Endemic		X				-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Rufous-eared Warbler	*Malcorus pectoralis*	-	Endemic	X					-	-	Moderate
Eastern Clapper Lark	*Mirafra fasciolata*	-	Near-endemic	X					-	-	Moderate
Sabota Lark	*Calendulauda sabota*	-	-	X					-	-	Moderate
Fawn-coloured Lark	*Calendulauda africanoides*	-	Near-endemic	X					-	-	Moderate
Red Lark	*Calendulauda burra*	Vulnerable	Endemic	X					-	-	Moderate
Spike-heeled Lark	*Chersomanes albofasciata*	-	-	X					-	-	Moderate
Karoo Long-billed Lark	*Certhilauda subcoronata*	-	Endemic	X					-	-	Moderate
Black-eared Sparrowlark	*Eremopterix australis*	-	Endemic	X					-	-	Moderate
Grey-backed Sparrowlark	*Eremopterix verticalis*	-	Near-endemic	X					-	-	Moderate
Red-capped Lark	*Calandrella cinerea*	-	-	X					-	-	Moderate
Stark's Lark	*Spizocorys starki*	-	Endemic	X					-	-	Moderate
Pink-billed Lark	*Spizocorys conirostris*	-	Near-endemic	X					-	-	Moderate
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Endemic	X					-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Large-billed Lark	*Galerida magnirostris*	-	Endemic	X					-	-	Moderate
Short-toed Rock-Thrush	*Monticola brevipes*	-	Near-endemic			X			-	-	Moderate
Karoo Thrush	*Turdus smithi*	-	Endemic		X				-	-	Moderate
Chat Flycatcher	*Bradornis infuscatus*	-	Near-endemic	X					-	-	Moderate
Marico Flycatcher	*Bradornis mariquensis*	-	Near-endemic	X	X				-	-	Moderate
Fiscal Flycatcher	*Sigelus silens*	-	Endemic		X				-	-	Moderate
Cape Robin-Chat	*Cossypha caffra*	-	-		X				-	-	Moderate
Kalahari Scrub-Robin	*Cercotrichas paena*	-	Near-endemic	X	X				-	-	Moderate
Karoo Scrub-Robin	*Cercotrichas coryphoeus*	-	Endemic	X	X				-	-	Moderate
Mountain Wheatear	*Oenanthe monticola*	-	Near-endemic	X		X			-	-	Moderate
Capped Wheatear	*Oenanthe pileata*	-	-	X					-	-	Moderate
Sickle-winged Chat	*Cercomela sinuata*	-	Endemic	X					-	-	Moderate
Karoo Chat	*Cercomela schlegelii*	-	Near-endemic	X					-	-	Moderate
Tractrac Chat	*Cercomela tractrac*	-	Near-endemic	X					-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Familiar Chat	*Cercomela familiaris*	-	-	X					-	-	Moderate
Ant-eating Chat	*Myrmecocichla formicivora*	-	Endemic	X					-	-	Moderate
Pale-winged Starling	*Onychognathus nabouroup*	-	Near-endemic			X		X	-	-	Moderate
Cape Glossy Starling	*Lamprotornis nitens*	-	-		X				-	-	Moderate
Pied Starling	*Spreo bicolor*	-	Endemic			X		X	-	-	Moderate
Wattled Starling	*Creatophora cinerea*	-	-	X	X			X	-	-	Moderate
Common Starling	*Sturnus vulgaris*	-	-		X	X			-	-	Moderate
Malachite Sunbird	*Nectarinia famosa*	-	-		X				-	-	Moderate
Dusky Sunbird	*Cinnyris fuscus*	-	Near-endemic	X	X				-	-	Moderate
Scaly-feathered Finch	*Sporopipes squamifrons*	-	Near-endemic	X					-	-	Moderate
White-browed Sparrow-Weaver	*Plocepasser mahali*	-	-	X	X				-	-	Moderate
Sociable Weaver	*Philetairus socius*	-	Endemic	X	X				-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
Southern Masked-Weaver	*Ploceus velatus*	-	-		X		X		-	-	Moderate
Red-billed Quelea	*Quelea quelea*	-	-	X	X		X	X	-	-	Moderate
Southern Red Bishop	*Euplectes orix*	-	-				X		-	-	Moderate
African Quailfinch	*Ortygospiza atricollis*	-	-	X					-	-	Moderate
Red-headed Finch	*Amadina erythrocephala*	-	Near-endemic	X	X				-	-	Moderate
Black-faced Waxbill	*Estrilda erythronotos*	-	-		X				-	-	Moderate
Common Waxbill	*Estrilda astrild*	-	-				X		-	-	Moderate
Violet-eared Waxbill	*Granatina granatina*	-	-	X	X				-	-	Moderate
Pin-tailed Whydah	*Vidua macroura*	-	-		X				-	-	Moderate
House Sparrow	*Passer domesticus*	-	-		X				-	-	Moderate
Cape Sparrow	*Passer melanurus*	-	Near-endemic	X	X				-	-	Moderate
Southern Grey-headed Sparrow	*Passer diffusus*	-	-	X	X				-	-	Moderate
Cape Wagtail	*Motacilla capensis*	-	-				X		-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat					Susceptibility to		
				Karoo veld	Drainage lines & alien trees	Screes and cuttings	Dams & ephemeral waterbodies	Fly over	Collision	Electro-cution	Disturbance / habitat loss
African Pipit	*Anthus cinnamomeus*	-	-			X			-	-	Moderate
Long-billed Pipit	*Anthus similis*	-	-	X					-	-	Moderate
Kimberley Pipit	*Anthus pseudosimilis*	-	Endemic	X					-	-	Moderate
Black-headed Canary	*Serinus alario*	-	Endemic	X					-	-	Moderate
Black-throated Canary	*Crithagra atrogularis*	-	-	X					-	-	Moderate
Yellow Canary	*Crithagra flaviventris*	-	Near-endemic	X					-	-	Moderate
White-throated Canary	*Crithagra albogularis*	-	Near-endemic	X					-	-	Moderate
Lark-like Bunting	*Emberiza impetuani*	-	Near-endemic	X					-	-	Moderate
Cape Bunting	*Emberiza capensis*	-	Near-endemic	X					-	-	Moderate

Annexure 1: Declaration of independence

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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

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

PROJECT TITLE

Proposed Klipgats Pan Solar Energy Facility at Copperton, Northern Cape

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4.2 The specialist appointed in terms of the Regulations

I, Andrew Jenkins declare that

General declaration:

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

Signature of the specialist:

Name of company (if applicable):
AVISENSE Consulting cc

Date:
2012-02-07